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UPPER MISSOURI RIVER BASIN LEVEL B STUDY REPORT AND ENVIRONMENTAL IMPACT STATEMENT

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Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

March 1981

9830 1

PREFACE

Technical papers were prepared by ad hoc groups during the study and provided detail and background information for the plan described in this report. These technical papers are available on a limited basis from the Missouri River Basin Commission. The technical papers developed are

- Socioeconomic Characteristics and Projections
- Flow Characteristics of Selected Streams In the Upper Missouri River Basin
- Inventory of Ground Water Resources
- An Inventory of Land Use and Ownership
- Descriptions of Programs and Institutional Framework
- Municipal, Industrial and Rural Domestic Water Supply
- Fish and Wildlife
- Agricultural Water
- Outdoor Recreation
- Environmental Characteristics
- Water Quality
- Flood Control and Erosion
- Land and Water Conservation Measures
- Energy Water Use
- Plan Formulation

An Environmental Impact Statement (EIS), required under the National Environmental Policy Act of 1969, is included as an appendix to this report. The probable impacts of the recommended plan are discussed in Chapter V and in the EIS.

Review comments from the official 90-day review by Commission member States and Federal agencies as provided by P.L. 89-80 are also appended to the report. The report will be transmitted to the U.S. Water Resources Council for review and transmittal to the President and then to the Congress.

The recommendations and actions suggested in this report are to be used as a guide in future water and related land resource conservation and management decisions by those responsible at the local, state, and national levels. The plan will be updated periodically through the Commission's comprehensive, coordinated, regional planning process and the State of Montana's water planning program.

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Soil Conservation Service p. 42
Water and Power Resources Service pp 46, 47 53, 55, 56, 60, 69 70, 107, 132
Ray Christensen, pp 6, 50

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[7] Dennis Christopherson also served in this position.
[8] Carlene Farmer and Steve Pilcher also served in this position.
[9] Carlene Farmer also served in this position.
[10] Mike Stephen also served in this position.

Citizen Advisory Committees

Four Citizen Advisory Committees were formed at the beginning of the study. Members and alternates on these committees provided counsel and guidance throughout the duration of the study. They served without compensation, receiving only travel reimbursement. Their contribution to the overall planning effort is gratefully acknowledged.

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(M) - Member (A) - Alternate

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	Lynn Martin (A)	John Delano (A)	Harold Dover (A)	
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	Jim Moore (A)	Alice Fryslie (A)	Cliff Haugen (A)	Willie Doll (A)
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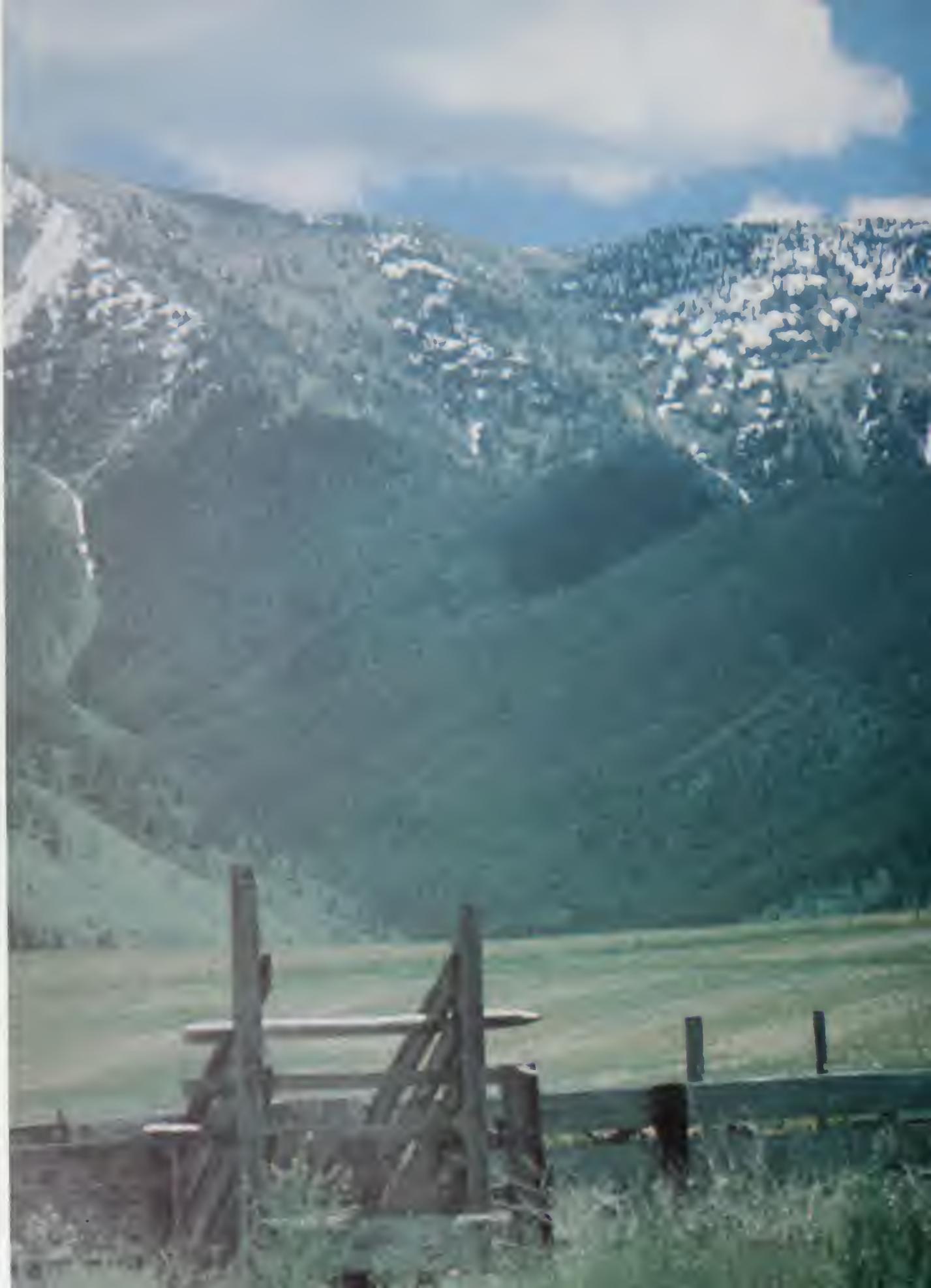
The draft Environmental Impact Statement was prepared by Don Becker and Carl Teinert of the Missouri River Basin Commission staff.



CHAPTER 1
INTRODUCTION

Summary

The Upper Missouri River Basin is a region on the verge of tough decisions over the use of its resources. Although sparsely populated (1975 estimate: 313,100), the area has potential problems in accommodating the continuing needs and wants of residents, and in responding to national needs and demands. If left unresolved--or if not addressed by effective planning--these problems could also adversely affect more populous areas of the nation.

Several crucial problem areas were identified in the study area. These included streambank erosion, flood damages, irrigation water shortages, water quality degradation, stream dewatering, sediment deposition and erosion and inadequate community water storage and distribution systems.

Specific streambank erosion was identified on the lower Judith River, lower Milk River and tributaries, Muddy Creek near Great Falls, upper Marias River, Cut Bank and Two Medicine Creeks, and Missouri River below Fort Peck Reservoir. Flood damages have been experienced regularly along the Sun River at Great Falls, lower Judith River and Wolf Creek, Milk River from Havre to the mouth, and streams in the Blackfeet Indian Reservation.

Late season irrigation water shortages were noted for the upper Beaverhead River and tributaries, and the Judith, Musselshell, and Milk Rivers. Likewise, low flows or dewatering conditions jeopardizing fish life were indicated for the Big Hole, Jefferson, Judith, Poplar, and Milk Rivers.

Sedimentation and water quality problems were identified on the Musselshell, Poplar, and Judith Rivers, and Big Muddy and Muddy Creeks. This sediment and erosion is causing damage to fish habitat and irrigation stream pumps as well as significant soil losses.

Opportunities for development of water for irrigation and hydropower were analyzed. Other opportunities for protection of fish and wildlife resources were also determined. These included riparian and wildlife habitat protection proposals and provisions for instream flows. Competition for water in the future is likely between hydropower, coal thermal power plants, fish and wildlife, irrigation, and municipal water supply. Questions surrounding Indian water rights and the federal reserved water claims need to be answered in any future planning endeavor.

The planning process described in this report addressed the foregoing problems and proposed several recommended actions. Some involve installation of structures to alleviate flooding or erosion damages. Others suggest detailed studies be conducted to better identify the effects of certain programs. Several point out a need to better inventory the existing conditions before embarking on programs for correction or improvement. A few advocate changes in existing legislation to better serve the purposes or meet the problems identified.

Implementation of these recommendations will require the cooperation of local citizens, state legislators, agency representatives and the Congress of the United States. Education and public information programs are a must if understanding and local support of program purposes are to be achieved.

The report is organized as follows. Chapter I outlines the study organization and process. Chapter II describes the resources of the area and the existing programs and laws which assist in managing these resources. Chapter III describes the current use and problems associated with those resources and a projection of future requirements or needs. Chapter IV discusses the process used in developing plans for managing the resources in the future. Chapter V describes the Recommended Plan selected and proposed for consideration by future decision-makers. Chapter VI briefly describes the future actions which will be necessary to implement the measures indentified in the Recommended Plan.

Background and Authority

The Missouri River Basin Comprehensive Framework Study, conducted between 1964

and 1969, identified several planning objectives for the Upper Missouri Subbasin. These included: definition of the subbasin's role in supplying national energy needs and its potential for agricultural development, the means necessary to meet environmental needs, answering legal and institutional questions regarding Indian and federal water rights, and determination of water supply and quality management needs.

The Water Resources Planning Act (P.L. 89-80, as amended) provided study authorization. The Act a) established the Water Resources Council, b) directed the Council to coordinate federal water and related land resources planning activities, c) provided for the establishment of river basin commissions, and d) provided for the administration of matching grants to states for water planning efforts.

Funding

Authorization and funding for the Upper Missouri Basin Level B study were provided by the Congress in October, 1977. Federal funds amounted to $995,000; state commitments, in accordance with Water Resources Council policy, were estimated at $250,000.

Purpose and Scope

The major study purpose was to develop a 15-20 year plan coordinating water and related land resource management. A secondary purpose was to integrate related independent planning efforts into a federally-required regional plan. Provision of future federal funding is expected to be based on programs outlined in an approved regional plan.

A Level B study encompasses water and related land resources, is comprehensive in scope, and conducted at a reconnaissance level. By definition, a Level B Study resolves complex, long-range problems or issues identified by various means, including framework studies. Scope and detail will, therefore, vary between studies and between functional areas within a study.

Study Area

The study area includes all of Montana drained by the Missouri River and its tributaries, except for the Yellowstone River, and also the St. Mary drainage at the extreme northwest corner. Although the St. Mary River is in the Hudson Bay drainage, it is included because a diversion from the St. Mary to the Milk River is in the Missouri River drainage.

The total study area is about 83,200 square miles including the portion in Yellowstone National Park. In addition, there are over 9,000 square miles of drainage area in Canada which have an impact on a portion of the study area. Canada elected to only maintain an awareness of study activities and, therefore, the Canadian portion was not included in the analysis. Use of the Milk and St. Mary River waters is covered by an international agreement discussed later in this report.

The study area, which includes all or parts of 39 counties, was divided into 5 planning areas (Figure 1) corresponding with the Water Resources Council's hydrologic breakdown. The planning areas and corresponding hydrologic unit numbers are: Upper Missouri Tributaries--1002, Missouri-Marias--1003, Missouri-Musselshell--1004, Milk--1005, and Missouri-Poplar--1006.

Guidelines

Water Resources Council guidelines and criteria were used. Additional criteria were developed to provide consistency in the planning process.

Principles and Standards

One Water Resources Council guideline developed for federal agencies is the **Principles and Standards for Planning Water and Related Land Resources** (P&S). The P&S define planning objectives, procedures and methodology. Two national objectives of land and water resources planning are defined as:

A. To enhance national economic development by increasing the value of the nation's output of goods and services and improving national economic efficiency.

B. To enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems.

In achieving the intent of the Principles and Standards, considerable latitude was employed by study participants. Single objective plans were developed for each plan-

Figure 1
PLANNING AREA DELINEATION

ning area for the purpose of a later comparison and trade-off between elements from each objective plan.

The national economic development (NED) plan requires that identified direct benefits be greater than total identified costs. The environmental quality (EQ) plan includes programs which produced identifiable, but not necessarily quantifiable, benefits of an environmental or social order. The Principles and Standards require all proposed plan elements to be evaluated under four accounts: national economic development, environmental quality, regional development and social well-being.

In addition to the Principles and Standards, the Water Resources Council set other guidelines. One was the use of current normalized agricultural prices in evaluating plan elements associated with agricultural production.

The Water Resources Council's discount rate of 6 7/8 percent for 1978 was used in this study. This is the interest rate used to discount future costs and benefits of potential projects.

The Study Management Board established study criteria and guidelines including: use of 1975 as the base year from which projections were made; projects constructed, under construction, or in operation as of January, 1978 were considered existing; existing international, federal, state and local laws, decrees and constraints were to be recognized during the planning process and appropriate modifications recommended.

Previous Studies

Previous studies conducted in the area, such as the framework study and studies conducted by state and federal agencies, were used in the planning process; thus

assisting study participants in maintaining an awareness of previous objectives, problems and concerns and minimizing duplication. For some programs and projects only updating of costs and benefits was required.

Organization

Figure 2 shows the study organization.

Missouri River Basin Commission

The Water Resources Council gave the Missouri River Basin Commission responsibility for conducting the study and authority to allocate study funds.

The Commission's Planning Committee reviewed and approved the Plan of Study. The Commission also maintained an awareness of study progress and problems through quarterly reports given by the Study Director. Commission staff members reviewed study reports, maintained administrative records, and prepared the draft Environmental Impact Statement.

Study Director

A study director was given authority for study management. The Director's responsibilities included developing a Plan of Study, chairing the Management Board, organizing the ad hoc groups, developing and maintaining a study schedule, and maintaining awareness of the study through public involvement efforts. The Study Director assisted several ad hoc groups in technical paper preparation. State agency and consultant contracts for specific tasks were administered through the Director's office.

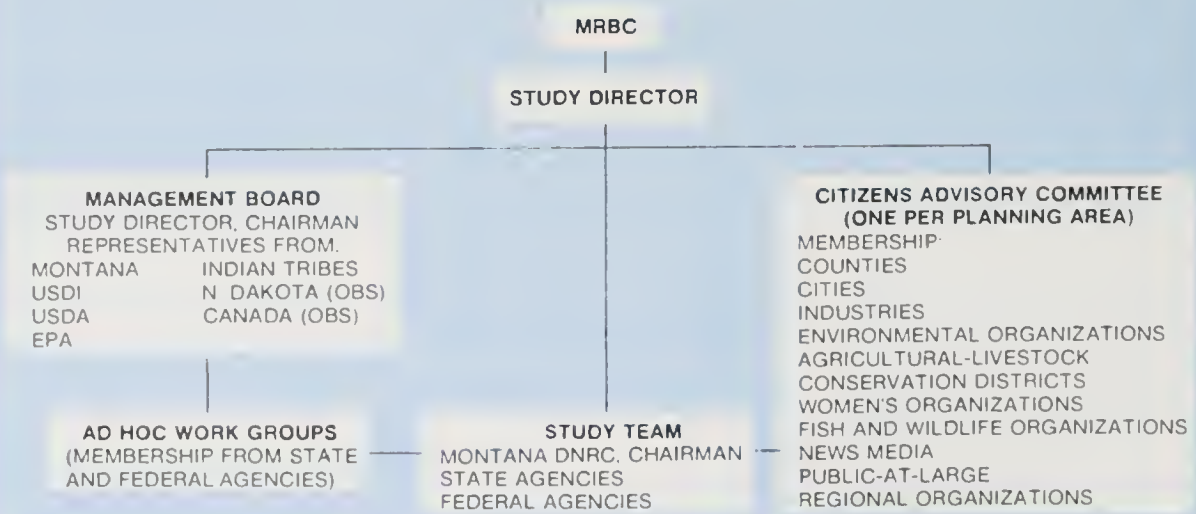
Staff assigned to the Director's office included an administrative assistant, technical coordinator and secretary. The administrative assistant was responsible for assisting with public involvement, including preparation of a newsletter and public meeting presentations. The technical coordinator assisted with plan formulation and was assigned as a member of the Study Team. Ad hoc group technical papers were reviewed for adequacy and clarity by the Director's staff.

Management Board

Management Board membership consisted of one representative from each of the following: State of Montana, U.S. Department of Agriculture, U.S. Department of the Interior, Environmental Protection Agency, and Indian tribes. The Study Director was chairman, representing the Missouri River Basin Commission. Observer status was provided the State of North Dakota and Canada because of their interest and the possible impacts of suggested study proposals.

The Board met monthly to monitor study progress, discuss problems, and resolve issues. Each Board member was responsible for the quality and timing of specific agency inputs

Figure 2
STUDY ORGANIZATION



in accordance with the Plan of Study and acted as liaison between the Board and ad hoc groups

The Board reviewed and approved ad hoc technical papers for completeness and compliance with the Plan of Study and reviewed the plan formulation activities of the Study Team The Board was also responsible for development of the main report, which includes the final conclusions and recommendations of the study

Study Team

An interagency Study Team was organized to formulate multiobjective plans. The Team utilized the Principles and Standards in evaluating proposed programs or projects for inclusion in the various plans.

Study Team leadership was assigned to the State of Montana to ensure coordination between this study and state water planning activities and because the study area was entirely within the state. Study Team members were representatives from the following agencies or departments:

Montana Department of —
- Natural Resources and Conservation
- Community Affairs
- State Lands
- Health and Environmental Sciences
- Fish, Wildlife and Parks

U.S. Department of Agriculture
- Forest Service
- Economics, Statistics and Cooperatives Service
- Soil Conservation Service

U.S. Department of the Interior
- Bureau of Land Management
- Fish and Wildlife Service
- Heritage Conservation and Recreation Service
- National Park Service
- Water and Power Resources Service

U.S. Department of the Army
- Corps of Engineers

U.S. Department of Energy
- Federal Energy Regulatory Commission

Missouri River Basin Commission

The Study Team was assigned responsibility for evaluating the proposed plan elements according to the four accounts. In some cases, this was accomplished by the ad hoc group which presented the proposal.

Documentation of the planning procedures and results was provided in a plan formulation technical paper prepared by the Study Team

Ad Hoc Groups

Sixteen ad hoc groups were established with membership comprised of representatives from state and federal agencies involved in water and related land resources management In addition to those state agencies represented on the Study Team, the Bureau of Mines and Geology and The Montana Power Company also participated on the ad hoc groups, other federal agencies were the Geological Survey, Bureau of Mines, and Bureau of Indian Affairs Some ad hoc groups were responsible for resource inventory, problem identification and development of alternative solutions

The work items assigned included base map preparation, socioeconomic characteristics and projects, and inventory of surface water resources, fish and wildlife requirements, water operation studies, ground water resources, inventory of land use, program evaluation, municipal, industrial and rural domestic water requirements, agricultural water requirements, environmental characteristics, outdoor recreation requirements, water quality requirements, land and water conservation measures, energy requirements and flood and erosion control.

Technical papers documenting the process and findings of each ad hoc group were prepared. The groups were disbanded after their assigned tasks had been approved by the Management Board

Citizen Advisory Committees

Formal public involvement in study activities was provided through citizen advisory committes (CAC's). Membership on the CAC's varied for each planning area, but, in general, included representation from most of the following interest areas:

- Agriculture
- Cities
- Counties
- Environment
- Fish and Wildlife
- Industry
- Public-at-large
- Livestock
- Regional Organizations
- Soil and Water Conservation Districts
- Water Development Organizations
- News Media
- Women's Organizations

The geographic areas of committee coverage corresponded with the planning areas defined

Study team meeting with Citizen Advisory Committee in Great Falls.

CAC's provided broad public representation and served as an avenue for bringing local problems, concerns, and potential solutions to the attention of study participants. Study information was provided the CAC's at periodic meetings held throughout the study area and questions and comments offered by CAC's were relayed to study participants. Local tours of problem areas and resources were conducted with CAC's during the course of the study. Preliminary plans and recommendations were previewed with the CAC's before being discussed with the pubic-at-large. Partial monetary assistance was provided CAC's by way of mileage payments for attendance at study meetings.

Procedures

Some of the procedures employed and the criteria adopted in development of the plan are discussed in the following sections.

The Plan of Study was developed early in 1978 by the Study Director with assistance from the Management Board. The Plan of Study outlined the tasks to be completed, those responsible for their completion, the time schedule, funding breakdown, final report outline, and general criteria and procedures to be followed by ad hoc groups and the study team.

Planning Process

Plan development required the repetitive analyses of several interrelated processes including: definition of objectives, resources inventory, problem and opportunity identification, estimation of future requirements and conditions, alternative plan formulation, and selection of a recommended plan. Figure 3 is a simplified flow chart showing the study process.

The planning process began with the resources inventory and identification of problems and opportunities. Problems and needs were identified from discussions with local citizens, analysis of agency reports and studies and estimation of future needs based on population projections and the capability of the Future Without A Plan condition. Many of the initial analyses were performed by the ad hoc groups.

Alternative solutions to many of the problems identified and opportunities for future management were developed by ad hoc groups and the Study Team. These solutions were augmented with programs or policies suggested by the CAC's.

Plan Formulation

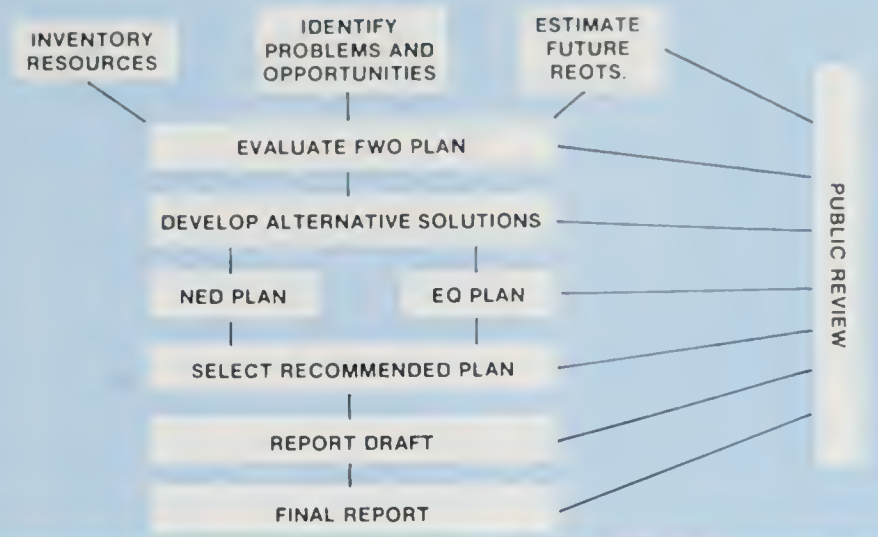
The Study Team analyzed various solutions for economic and physical feasibility and environmental protection or enhancement. The suggested solutions were integrated and their impacts were categorized by the four accounts required in the Principles and Standards. Trade-offs were required in some instances to alleviate conflicts between elements. Results of the formulation process were reviewed with the CAC's and the public-at-large at different stages and suggested comments and changes were incorporated where appropriate.

Future Without a Plan

An estimate of conditions expected to occur or prevail in the future without a coordinated planning approach was necessary to establish a base line from which to measure the contributions or effects of the proposed plan. In arriving at the Future Without (FWO) estimate, historic rates and levels of program implementation were assumed to continue in most cases. In some instances, adjustments were made to reflect recent trends or opinions offered by those in close association with the programs. It was generally agreed that no major comprehensive management programs would be initiated under FWO conditions. This appears reasonable in light of recent action by the Water Resources Council requiring approved regional plans for all affected areas.

FWO estimates were compared to existing problems and resources to determine the extent of solutions and provision expected under the FWO. Remaining problems and requirements were addressed by either the NED or EQ plans.

Figure 3
PLANNING PROCESS



National Economic Development Plan

National economic development (NED) plans were developed for each planning area. Varying levels of NED planning are provided for in the Principles and Standards planning guidelines. However, time constraints limited the analysis in this study to one alternative NED Plan.

The NED Plan included potential programs and projects whose primary function was to improve or increase the nation's economic development. All measures in the NED Plan were required to have annual benefits that exceeded annual measurable costs.

Environmental Quality Plan

A plan emphasizing management and improvement of the environment was also developed for each planning area Impacts of the environmental quality (EQ) plan were categorized by the four accounts previously identified, although in many cases, dollar costs could not be specified. Again, time constraints permitted analysis of only one alternative EQ Plan

Recommended Plan

The recommended plan (RP) was formulated by the Study Team from the two single objective plans (NED, EQ). Development of the RP required the use of trade-offs and some modification of original plan elements. Evolvement of the RP was achieved through consideration of the priorities and preferences expressed by the affected public, as well as the best judgment of the study participants.

Public Participation

The Principles and Standards require that planning results reflect the priorities and preferences expressed by the affected public To achieve this objective, two levels of public participation were enlisted: the involvement of the public-at-large and the formation of citizen advisory committees

Public Meetings

In addition to the citizen advisory committee meetings, two series of public meetings were held in the study area. The first series took place early in the study period and was held at Dillon, Helena, Lewistown, Great Falls, Havre, Cut Bank, and Wolf Point to acquaint the public with the purpose of the study, to solicit assistance in identifying water, and related resource problems and solutions, to describe the procedures to be employed, and the study organization proposed

A second series of seven meetings occurred toward the end of the study when the preliminary recommended plan was presented and discussed with citizens at Lewistown, Wolf Point, Havre, Great Falls, Helena, Dillon and Bozeman Comments and suggestions from these meetings were considered and incorporated in the final draft plan

CHAPTER II

THE STUDY AREA AND ITS RESOURCES

Planning the future of the Upper Missouri River Basin's water and related land resources must include an overview of the area's topography, minerals, soils, cultural (social and economic) characteristics, water use, and historical development. Such a description provides insight into limits of these resources and, as a result, attractiveness for future development.

Resource utilization is regulated by land and water use programs administered at federal, state and local levels. These programs and legal framework establish parameters within which planning and implementation is confined.

Physical Characteristics

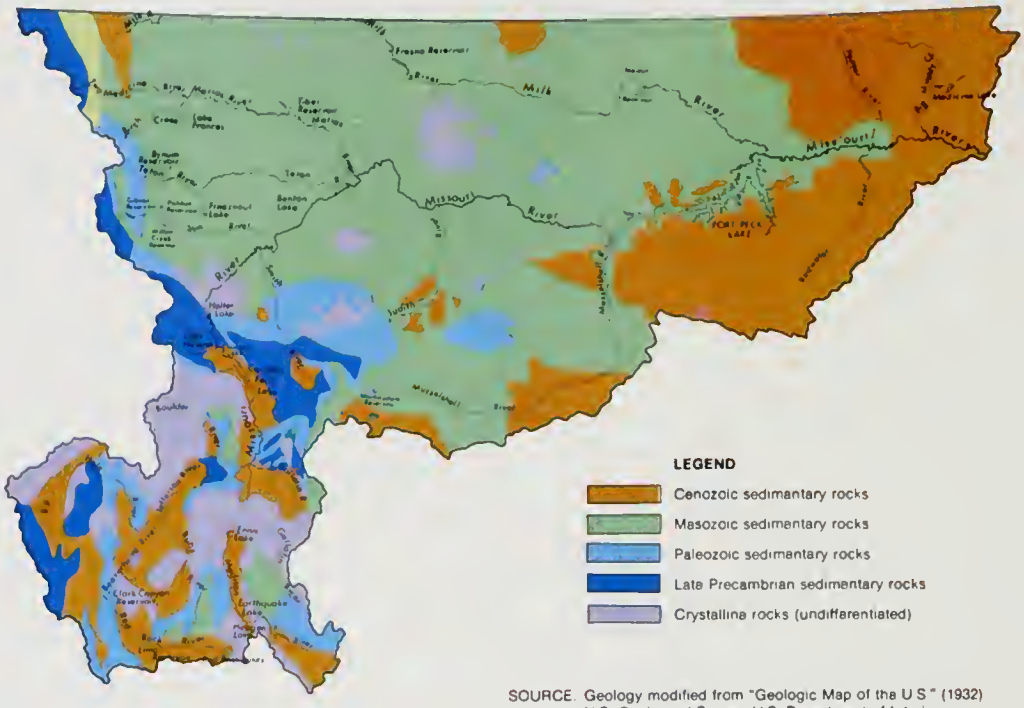
The Upper Missouri, which includes over half of Montana, displays a varied array of topography ranging from alpine meadows to grassy prairies. The stream network varies from the clear, mountain brooks of the upper tributaries to the slow-moving, sediment-laden flows of some tributaries in the lower reaches. Industries dominating the western planning areas are irrigated agriculture and forest products; whereas the economy of the eastern and northern portions is based on grazing and dry cropland.

Geology and Topography

Geology and topography vary significantly throughout the study area (Figures 4 and 5). The western and southwestern portions exhibit a mountainous topography while the northeastern section is characterized by level to deeply dissected topography in a semi-arid environment. Elevations range from Koch Peak at 11, 286 feet in the southwest to 1,872 feet near the North Dakota border.

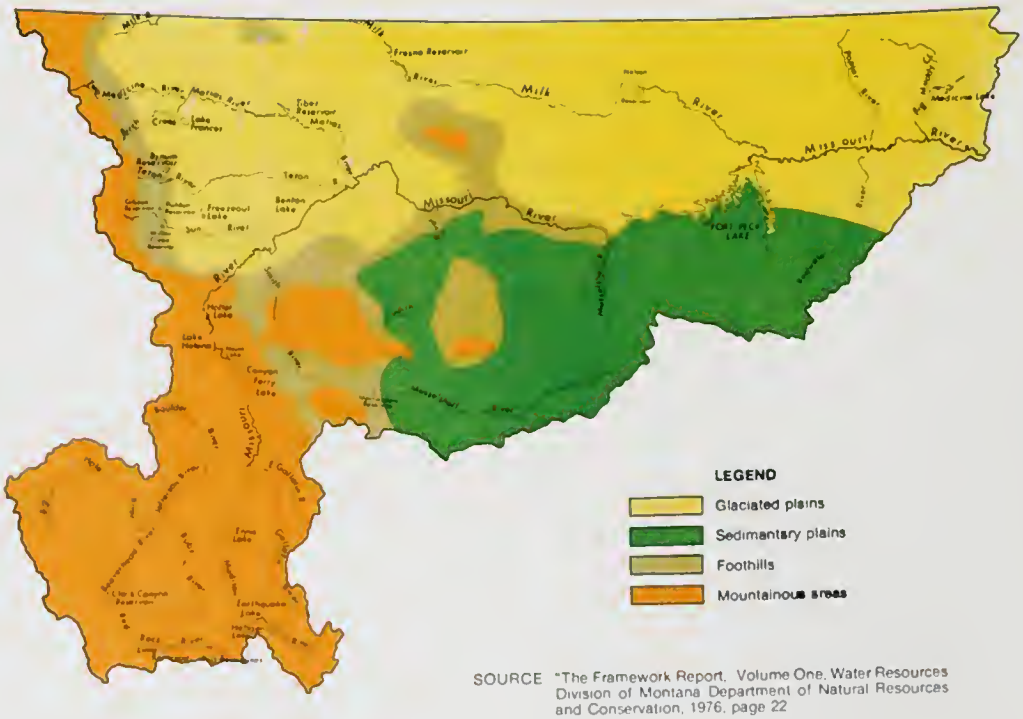
The Jefferson, Madison, and Gallatin Rivers combine to form the Missouri River near Three Forks in the southwest part of the study area.

Figure 4
GENERALIZED GEOLOGY



SOURCE. Geology modified from "Geologic Map of the U S" (1932) U.S. Geological Survey, U.S. Department of Interior

Figure 5
TOPOGRAPHIC REGIONS



SOURCE "The Framework Report, Volume One, Water Resources Division of Montana Department of Natural Resources and Conservation, 1976, page 22

Figure 6

The western-most tributary of the Jefferson, the Big Hole River, flows through a high (6,000-foot base), wide valley ringed by 9,000-10,000-foot peaks of the Pioneer Mountains on the east and the Beaverhead Mountains on the west Irrigated meadow hay is the principal crop of this valley. The Big Hole River, approximately 100 miles long, runs north through the valley, turns east and forms a rough semi-circle before joining the Beaverhead River at Twin Bridges to form the Jefferson River. (See Figure 6).

Big Hole River near Glen.

The Red Rock River begins in the Centennial Valley at the extreme southern end of the study area and joins Horse Prairie Creek at Clark Canyon Dam to form the Beaverhead The Beaverhead flows north towards its junction with the Big Hole and is joined by the Ruby River from the east. Dominating this area from west to east are the Pioneer Highland Mountains, Tobacco Root, Ruby, and Gravelly Ranges. Peak elevations range from 9,000-11,000 feet

The Madison and Gallatin River both head in Yellowstone National Park and flow through intermountain valleys devoted mostly to livestock production. Valley elevations range from 4,000-6,000 feet. The dominant mountain ranges are the Gravelly, Madison, and Gallatin

Bedrock formations include shale, sandstone, quartzite, limestone, siltstone, and granite intrusions, which are exposed in the mountain ranges and along their flanks Alluvial and colluvial deposits overlie bedrock in the valley areas Sandstone, volcanic ash and unconsolidated mixtures of boulders, gravel, sand, silt and clay are present over broad areas in these valleys.

The area's western portion is characterized by a transitional zone between wide, intermountain valleys and broad expanses of high northern plains. Several mountain ranges are scattered through this section, including the Big Belt Mountains, east of Canyon Ferry Reservoir, and Little Belt Mountains, north of White Sulphur Springs. The northern half, composed of fairly level to deeply dissected plains formed by glacial and alluvial action, is known as the "Golden Triangle." and is the most productive grain producing region in the state.

The Missouri River forms a broad, alluvial valley between the Elkhorn and Big Belt Mountains. Valley floor to peak elevations range from 4,000 to over 9,000 feet. The Missouri cuts north through Wolf Creek Canyon, is joined by the Smith River from the East, and meanders across open plains to Great Falls.

The northwest part, bounded by the Sun River on the south and the Lewis Range on the west, is largely covered by glacial drift in rolling to level plains used for livestock and irrigated and dry cropland agriculture. The Sun, Teton, Dearborn, and Marias are the major rivers draining this portion.

Mountain ranges in this area were created by widespread uplifts of limestone, shale, dolomite, argillite, quartzite, and by intrusion of volcanic and granite rocks. Large valleys between the mountain ranges were filled with thick deposits of sedimentary materials because of repeated glaciation. The deposits include terminal and ground moraines, outwash channels and lake sediments of sand, gravel, silt, and clay as much as 200 feet thick.

The Upper Missouri Basin's high mountain ranges and broad, alluvial valleys were formed by structural deformation of sedimentary rocks and by the intrusion of large igneous masses. Subsequent glaciation was largely responsible for many of the present land forms, such as the high mountain valleys, ridges, and lakes.

From the Little Belts, Crazy and Castle Mountains in the south-central portion of the study area, the Musselshell River flows east through rolling to level sedimentary landforms until it turns north and meanders through eroded badlands to its confluence with the Missouri. To the north, the Judith River flows between the Little Belt and Big Snowy Mountains and joins the Missouri approximately 50 miles north of Lewistown. The Missouri River flows east forming the "Missouri Breaks," an area of canyon lands, before flowing into Fort Peck Reservoir.

In addition to the Little Belts, the Big Snowy, Judith, and Moccasin Mountains occur as isolated uplifts. These mountainous regions are composed of limestone, quartzite, sandstone, and igneous rocks with peak elevations ranging from 7,000-9,000 feet.

Missouri River in the central part of the state.

Interbedded formations of sandstone, clay, shale, and coal, as much as 2,000 feet in thickness, occur near Roundup. Much of the area adjacent to the Missouri and east of Roundup is covered by the Bearpaw Shale formation, a dark, dense marine shale approximately 1,000 feet thick.

The Milk River is the only major stream draining the north-central part of the area. The St. Mary River, because of a diversion of a portion of its water to the Milk, is also located here. The St. Mary River rises in the deeply glaciated mountains of Glacier National Park, where peak elevations exceed 10,000 feet, and flows through the Blackfeet Indian Reservation before leaving Montana. The Milk River, south and east of the St. Mary, also leaves Montana but reenters the state approximately 100 miles from its initial exit. Along its lower 650 mile course, the Milk River provides irrigation water for bottom and terrace lands before discharging into the Missouri just below Fort Peck Dam.

Shale and sandstone formations make up much of the bedrock along the Milk River drainage. Alluvium in the Milk River Valley consists of sand, silt, and clay overlying older glacial deposits.

With the exception of the mountainous western portion, the Bearpaw and Little Rocky Mountains south of the river, and the Sweetgrass Hills to the north, the area is characterized by relatively level, rolling country and badlands. Average elevation of this drainage area is 2,500-3,000 feet, dropping to about 2,000 feet where the Milk enters the Missouri River.

The remainder of the study area includes the Missouri River below the confluence of the Milk River to the North Dakota border. Tributaries to the Missouri in this reach include the Poplar and Redwater Rivers, and Wolf and Big Muddy Creeks. Topography varies from rolling hills to flat plains in the northern half of the area to undulating, broken plains and badlands adjacent to the Missouri River. Elevations vary from 3,600 feet in the Big Sheep Mountains of McCone County to just under 1,900 feet near the North Dakota border.

Sandstone and interlayered clay, silt, lignite, and shale overlies marine sediments as much as 1,400 feet thick. Continental glaciation left morainal material overlaying these sediments. This material consists predominantly of boulders, silt and clay, with thin zones of gravel and sand. The glacial deposits range from several feet to more than 200 feet in thickness.

Climate

Because of the study area's large size, elevation differences, and northern continental position, great climatic variations occur. Summertime high temperatures usually range from 80-110 degrees Fahrenheit, and often drop to 50-60 degrees at night. Polar continental air masses bring winter low temperatures down to 40 degrees or more below 0 degrees Fahrenheit. Table 1 illustrates temperature and precipitation averages for several representative stations.

Table 1
NORMAL TEMPERATURES[a] and PRECIPITATION[b]

Month		Station: Bozeman	Great Falls	Havre	Lewistown	Wolf Point
Jan	Temp	20.8	20.5	11.9	19.1	8.0
	Precip	0.92	0.88	0.52	0.68	0.50
Feb	Temp	26.2	26.6	18.0	23.8	14.5
	Precip	0.65	0.75	0.40	0.59	0.40
March	Temp	29.9	30.5	26.4	27.5	25.4
	Precip	1.44	0.97	0.49	0.71	0.52
April	Temp	41.9	43.4	42.5	40.1	43.0
	Precip	1.78	1.18	1.02	1.00	1.17
May	Temp	50.8	53.3	53.6	49.6	54.6
	Precip	2.67	2.37	1.48	3.08	1.61
June	Temp	57.6	60.8	60.9	56.6	63.2
	Precip	3.22	3.11	2.55	4.08	3.27
July	Temp	66.4	69.3	69.4	65.5	70.5
	Precip	1.30	1.27	1.38	1.62	2.03
August	Temp	65.0	67.4	67.4	64.4	68.7
	Precip	1.37	1.09	1.05	1.70	1.80
Sept	Temp	55.3	57.3	56.0	54.0	57.1
	Precip	1.76	1.17	1.11	1.64	1.07
Oct	Temp	45.9	48.3	45.4	45.5	45.8
	Precip	1.46	0.68	0.67	1.00	0.58
Nov	Temp	32.5	34.6	29.1	32.2	28.5
	Precip	1.26	0.81	0.46	0.71	0.45
Dec	Temp	25.1	26.5	18.3	24.5	15.9
	Precip	0.83	0.71	0.42	0.66	0.38
Annual	Temp	43.1	44.9	41.6	41.9	41.3
	Precip	18.66	14.99	11.55	17.47	13.78

[a] Temperatures in degrees Fahrenheit.
[b] Precipitation in inches.

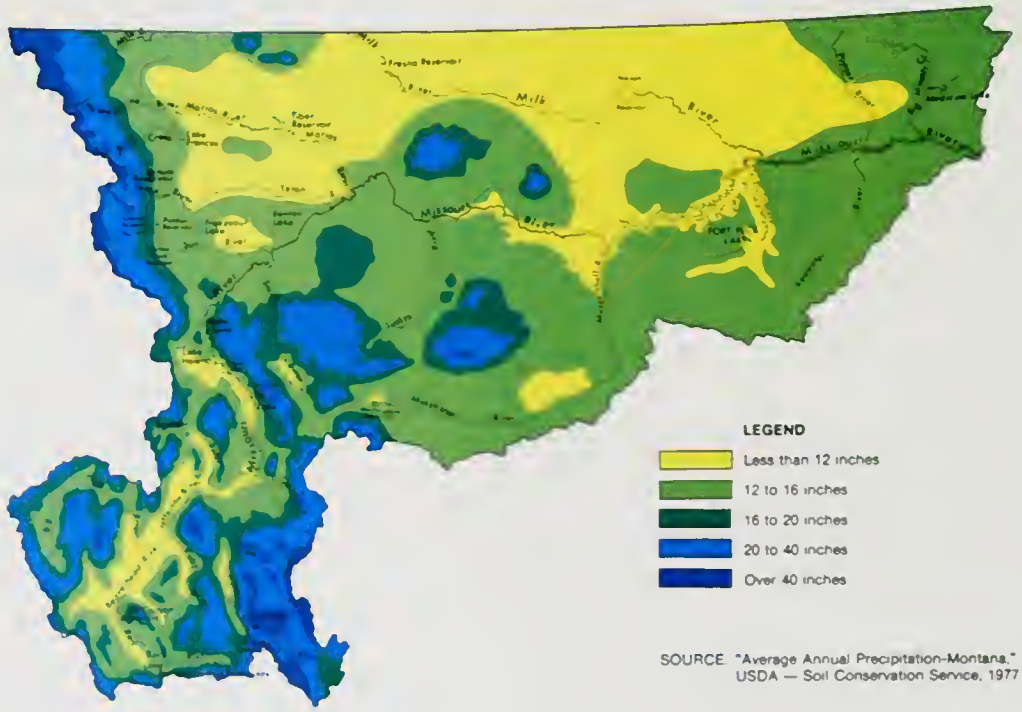
Extremely cold, dense, Canadian air masses dominate the area during the winter. These usually occur 6-12 times a year and cause temperatures to drop well below zero. However, downslope, warm, chinook winds reaching speeds of 25 to 50 mph can persist for several days modifying the cold waves. Such winds can drastically change temperatures from well below zero to 30-50 degrees in a matter of hours. This chinook belt extends from Browning to the Yellowstone Valley above Billings, and chinooks are common as far southwest as Bozeman and Dillon.

Topography exerts a marked influence on precipitation. The wettest areas are in the mountain ranges except where a "rain-shadow" effect occurs, such as in the Dillon, Townsend, and Helena areas, where average annual precipitation is 10 inches or less. Areas in the Tobacco Roots and Pioneer Ranges receive 50 inches and more, while the mountains west of the St. Mary River receive over 100 inches of precipitation. Most of this comes as snow and falls during the November-March period. Heavy snowstorms can occur as early as mid-September or as late as mid-May in the higher southwestern part of the study area. Figure 7 illustrates these precipitation variations.

Moist pacific maritime air masses from the northwest coastal areas are responsible for much of the winter and summer precipitation. Polar, Canadian air masses are responsible for the dry, winter weather dominating the northern and eastern portions. Spring showfall and summer rains in southwest and central portions result from warm, moist, air masses pushing into the state from the Gulf of Mexico.

Streamflows peak in the spring and early summer months as a result of melting winter snowpack. This snowmelt, coupled with occasional heavy spring rainfall and ice jamming on some rivers, often causes serious flooding along many of the streams. Locally heavy thunderstorms often result in spring and summer flash floods.

Figure 7
AVERAGE ANNUAL PRECIPITATION
1941-1970



SOURCE: "Average Annual Precipitation-Montana," USDA — Soil Conservation Service, 1977

Soils

Soils that developed in forested uplands in the western part vary significantly from those on the level to rolling foothills and bottomlands characteristic of the eastern plains. Figure 8 illustrates the study area's major soil groupings.

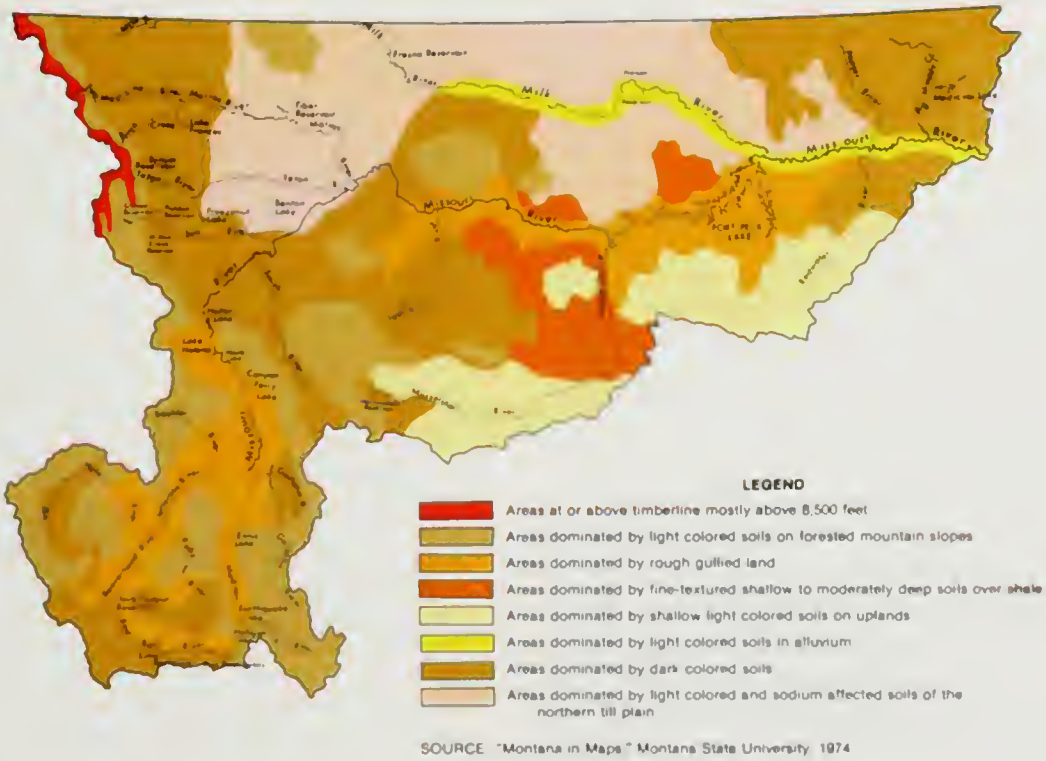
In the mountainous western and central part of the Upper Missouri, the soil cover consists largely of partially decomposed rock. Shallow, stony loams have developed over granite, sandstone, and limestone bedrock on these sloping to steep lands. In the mountain valleys, fine-textured soils have developed in mixed materials derived mainly from sedimentary and igneous bedrock. The major soil groups change with decreasing elevation from the light-colored soils developed under forest-cover to the dark-colored soils developed under grasses in the lower valleys and plains.

On level to sloping benches adjacent to mountainous areas, medium-textured soils formed in alluvium. These soils range from shallow to moderately deep and are primarily used for grain and hay production.

Vegetation and terrain near Beaver Creek in the north-central part of the Upper Missouri study area.

The dark-colored soils in the valleys and lower plains are moderately deep to very deep, are mainly well-drained and have well-defined soil horizons. These soils cover large valley areas in the Missouri headwaters,

Figure 8
SOILS



SOURCE "Montana in Maps" Montana State University 1974

valley areas west of Great Falls, and large upland areas in the vicinity of Lewistown.

Alpine and continental glaciation have been dominant erosional forces in high mountain valleys in the south and west part of the Upper Missouri, and over large areas east of the mountain front from Great Falls to the Canadian border. Shallow, stony soils developed in glacial till in the mountain valleys. Continental glaciation influenced the soils in much of the Piedmont area east of the Lewis Range. These soils vary from clay to fine sandy loams and are underlain by glacial till. Gravel and sands settled near ice margins and silts and clays were deposited in water bodies. The latter are influenced by alkali salts and present a scabby appearance. They are mostly used as rangeland.

Soils developed in the Musselshell area are the result of the weathering of sandstone and shale sedimentary bedrock. These soils range from loam to clay in texture. The semi-consolidated shales have weathered into clay hills separated by wide, flat, saline areas.

Dominating much of the undulating to nearly level, glacial till plains north of the Milk River are soils characterized by a gray, loose, structureless surface over a clay subsoil, underlain by a glacial till substratum. Within this soil area are bare spots locally called "blow outs," or "panspots" which occupy as much as 20-60 percent of the surface area. These soils are used mainly for livestock grazing with a few used for dryland crops.

Many of the soils of the Missouri-Poplar area were influenced by glaciation. The soils and their parent material are similar to those formed in the Piedmont area east of the Lewis Mountains. Post-glacial sedimentation has filled in many of the stream valleys with alluvium. This region supports grazing and small grain production.

Vegetation

Native plant communities are diverse in response to the area's wide variations in precipitation, growing season, and soils. Ranching, timber harvesting, fire, and insects have also affected the diversity. Large areas of native grasslands have been converted to cropland and pasture. Much of the conversion has occurred in the glaciated plains region north of the Missouri River where approximately 40 percent is now in cropland or pasture.

Grasslands occupy the high plains. Dominant species include blue grama, needle-and-thread, threadleaf sedge, and western wheatgrass. Within the plains region, the area known as the Missouri Breaks is a complex of grassland and scrub forest. Predominant grasses are bluebunch wheatgrass, little bluestem, prairie sandreed, and plains muhly. Common trees are ponderosa pine and Rocky Mountain juniper. Missouri River valley bottoms are a complex of grassland and bottomland cottonwood tree cover. Grasslands also predominate on mountain foothills.

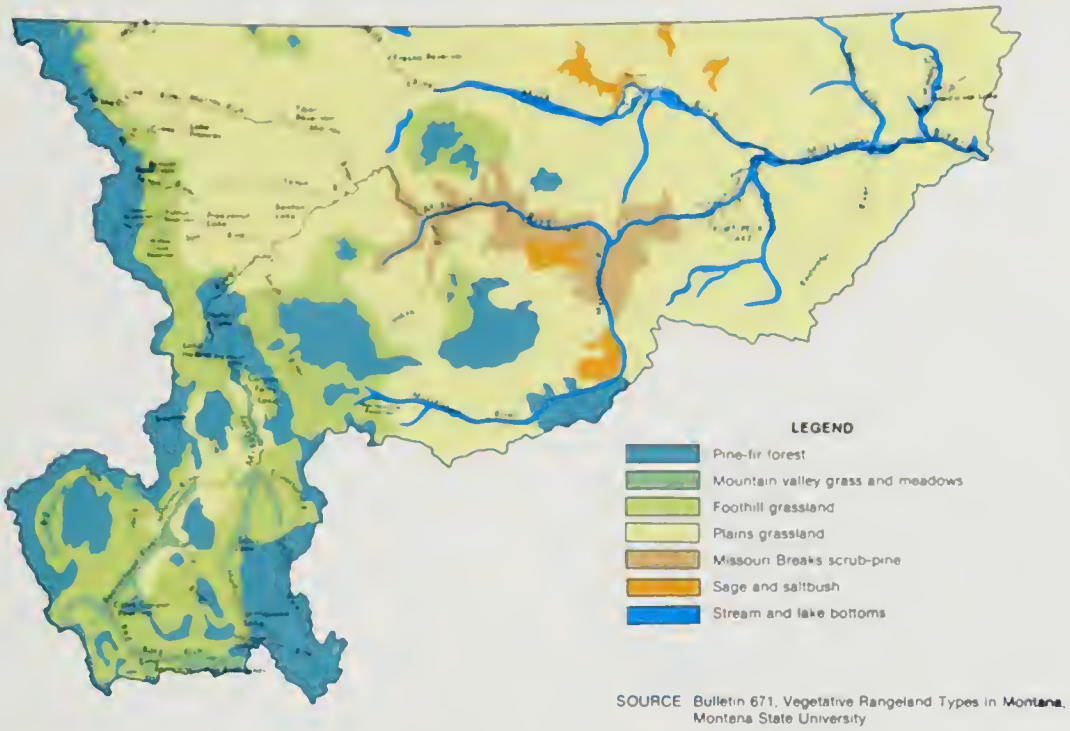
Forests of ponderosa pine occur at higher elevations in the plains region where annual precipitation approaches 14 inches. In some locations on north-facing slopes, douglas fir is a major tree species.

Grasslands in the valleys of the upper Missouri headwaters are made up of cheatgrass brome and needle-and-thread. Hairgrasses, Kentucky bluegrass, sedges, redtop, and timothy are found on subirrigated sites. The foothills' grassland area in Beaverhead and Madison Counties contains large amounts of big sagebrush. Willows, cottonwoods, and other phreatophytes are common along streambanks. Forests cover the mountain areas and finger into the foothills, mostly on north-facing slopes. The predominant forest types are lodgepole pine and douglas fir. At high elevations, stands of subalpine fir and spruce become extensive. Ponderosa pine occurs as a scattered component of forest stands at low elevations and on south and west portions of the douglas fir forest type in mountain watersheds below the three forks of the Missouri River.

Most of the St. Mary River drainage is forested. Unique to this area is the largest grove of quaking aspen within the state. It occurs on primarily lower elevation, east-facing slopes of the mountains and in association with closed drainage on the glacial till plains. The glacial till plains, with the exception of the "pot hole" areas, is predominantly grass-covered. Lower elevation, west-facing slopes of the mountains are forested primarily with douglas fir and the higher elevations are forested by lodgepole pine. Within Glacier National Park, plant communities representing alpine tundra can be found. The grassland areas are dominated by rough fescue, Idaho fescue, bearded wheatgrass, and Parry danthonia.

Figure 9 shows the primary vegetation types within the study area.

Figure 9
VEGETATIVE RANGELAND TYPES



SOURCE Bulletin 671, Vegetative Rangeland Types in Montana, Montana State University

Rangeland

Rangeland comprises a major portion of the study area (25 million acres). The range ecosystems are complex and diverse in their ability to produce native vegetation important to both livestock and wildlife.

The foothills and mountain valleys are dominated by such species as bluebunch wheatgrass, Idaho fescue, spike fescue, and rough fescue and a variety of perennial forbs. Sagebrush may also occur in these areas.

Rangeland associated with the downstream or plains area is found on drier sites and differs in its ability to produce certain kinds of vegetation. Plant communities will vary from a sagebrush-rabbitbrush dominated plant community to perennial grasses represented by western wheatgrass, needle-and-thread grass, and bluebunch wheatgrass.

Minerals

A tremendous variety of minerals occurs in the Upper Missouri. The major mineral commodities extracted are petroleum, natural gas, bentonite, limestone, copper, gold, silver, lead, zinc, gypsum, talc, tungsten, and silica. Common construction materials, such as sand and gravel, stone and clay, are produced in most counties.

Granite and other volcanic origin rocks form the mountain cores. Associated with these rocks are gold, silver, copper, lead, zinc, molybdenum, and tungsten deposits. Many of these are related to fractures and rock deformation associated with extreme pressure. These minerals occur as veins in igneous and sedimentary rocks; as contacts between igneous and sedimentary rocks; and as isolated quartz bodies in areas of folding and faulting.

Minerals have been mined in ranges such as the Little Rockies, Judith, Little Belt, Bearpaws, and Castle Mountains. The Tobacco Roots, Big Belts, and mountainous areas south and west of Helena account for much of the existing mineral production.

Nonmetallic minerals are produced from sedimentary deposits. Bentonite is mined

from shale outcrops in northcentral Montana. Gypsum is mined from cretaceous deposits near Hanover, northwest of Lewistown. Coal is extracted from the Tongue River member of the Fort Union Formation. Little coal mining presently occurs in the Upper Missouri; however, the northeastern corner is underlain by extensive lignitic coal seams that could be mined in the future. More than 1.1 million acres of land, which has surface and subsurface mineral resources (excluding coal), may be affected by mining.[1]

[1]Mineral Industry Water and Land Needs, pg. 14, UMRB, W. Hale, 1979.

TABLE 2
RESERVOIRS HAVING A TOTAL CAPACITY OF 5,000 ACRE-FEET OR MORE

Name (acre-feet)	Stream (acre-feet)	Total Storage (acres)	Active Storage	Surface Area	Purposes[a]
Ackley Lake	Offstream Judith River	6,140	5,815	250	I
Bair	North Fork Mussellshell R.	7,030	7,010	252	I
Beaver Creek	Beaver Creek	7,230	6,360	204	FC,I,FW,R
Bynum	Offstream Teton River	75,000	74,500	4,120	I
Canyon Ferry	Missouri River	2,051,000	2,043,000	35,200	FC,I,FW,P
Clark Canyon	Beaverhead River	328,900	328,900	10,000	FC,I,FW
Deadman's Basin	Offstream Mussellshell R.	76,900	72,220	2,042	I
Delmoe Lake	Pipestone Creek	6,600	6,600	479	I
East Fork	Big Spring Creek	5,297	5,004	226	FC,R
Ennis Lake	Madison River	42,060	42,060	3,800	P
Eureka	Teton River	5,500	5,000	400	I
Fort Peck	Missouri River	19,410,000	13,915,000	245,000	M,FC,P,I,N
Four Horns	Badger Creek	20,000	19,250	897	I
Frenchman	Frenchman Creek	7,010	7,010	806	I
Fresno	Milk River	129,000	127,200	5,757	FW,M,I,FC
Gibson	Sun River	105,000	104,800	1,360	I,FW
Hauser Lake	Missouri River	98,230	51,420	3,800	P
Hebgen Lake	Madison River	384,800	377,500	12,668	P
Holter Lake	Missouri River	240,420	81,920	4,800	P
Kipps Lake	Offstream Willow Cr	5,009	4,500	335	L,I
Lake Francis	Offstream Dupuyer & Birch Creek	117,000	111,900	5,536	I
Lake Helena	Missouri River	10,450	10,450	610	L,M
Lake Sherbourne	Swiftcurrent Creek	66,200	66,200	1,730	I,M
Lima	Red Rock River	84,050	84,050	6,400	I
Lower Two Medicine Lake	Two Medicine Creek	13,500	11,880	806	I
Martinsdale	Offstream So. Fork Musselshell River	23,185	23,105	1,050	I
Middle Creek	Middle or Hyalite Cr.	8,030	7,821	223	M,I
Morony	Missouri River	13,260	7,900	300	P
Nelson	Offstream Milk River	85,450	66,800	4,560	FW,I
Newlan Creek	Newlan Creek	14,030	13,810	327	FC,I,FW,R
Nilan	Offstream Smith & Ford Creeks	10,990	10,092	535	I
North Fork Smith River	North Fork Smith R	11,600	11,550	335	I
Petrolia	Flatwillow Creek	9,192	8,822	515	I
Pishkun	Offstream North Fork Sun River	48,450	32,050	1,550	I
Ruby River	Ruby River	38,850	38,500	970	I
Swift	Birch Creek	30,015	29,980	455	I
Tiber	Marias River	1,368,000	762,000	22,180	FW,I,FC,M
Warhorse Lake	Offstream Ford Creek	23,800	23,800	1,560	I
Whitetail	Whitetail Creek	6,200	4,000	830	I
Willow Creek	Offstream Sun River	32,400	32,230	1,450	I,FW
Willow Creek	Willow Creek	18,000	17,730	850	I
Total		25,043,778	18,659,757	385,168	

[a]I--Irrigation, FC--Flood Control, FW--Fish and Wildlife, P--Power, M--Municipal, L--Livestock, R--Recreation, N--Navigation

SOURCE: **The Framework Report**; Volume 1, Department of Natural Resources and Conservation, 1976, and Soil Conservation Service.

Surface Water

The Missouri River Basin is the largest in the state and contains approximately 56 percent of the land area. However, only 17 percent of the surface water discharged from the state, an average of 7.3 million acre-feet per year,[2] leaves through this basin. This is less than the annual discharge of either the Kootenai, Clark Fork or Yellowstone Rivers.

Besides the Jefferson, Madison, and Gallatin Rivers that initially form the Missouri, the Dearborn, Smith, Sun, Teton, Marias, Judith, and Musselshell Rivers add their volume to the mainstem Missouri. The Milk River discharges into the Missouri below Fort Peck Dam. The amount of water contributed by the Canadian portion of the Missouri River Drainage averages about 450,000 acre-feet annually.

Several reservoirs provide partial regulation of the surface flows. With a total storage capacity of over 19 million acre-feet, Fort Peck Reservoir on the mainstem of the Missouri is the largest reservoir in the state. Canyon Ferry and Elwell (Tiber) Reservoirs are also large, with total storage capacities of approximately 2 million and 1.3 million acre-feet respectively. There are 38 reservoirs in the study area with storage capacities of 5,000 acre-feet or more. In addition, there are several thousand small reservoirs and stock ponds used for irrigation, flood prevention, and stock watering. Those reservoirs having a total storage capacity of 5,000 acre-feet or more are shown in table 2.

[2]Comprehensive Water and Land Resources Plan for the State of Montana, Department of Natural Resources and Conservation, 1976.

Snow melt in the high mountains starts in April and peaks in May or June. By July, the spring runoff is over and normal flows resume, modified by summer rains or diversions. Irrigation diversions may drastically reduce stream flows in many streams during high water demand years. Streams originating in the plains often reach peak flows in late March and April and generally cease surface flow during July and August.

Fort Peck Dam and Reservoir.

Streamflows vary considerably from year to year and from area to area. Some of the smaller mountain streams may have as high as 100 inches of runoff annually from parts of their drainage areas while streams in the semi-arid eastern portion may have as little as 0.5 inch of runoff in a dry year. Table 3 shows annual flow ranges for several streams.

TABLE 3
ANNUAL FLOW RANGE FOR SELECTED STREAMS

Stream & Station	Drainage Area	Annual Flow (1929-75) Mean	1975 Depleted[a]	Maximum[b]	Minimum[b]
	(sq. mi.)	(1,000 acre-feet)			
Beaverhead River near Twin Bridges	3,619	269	308	440(1972)	183(1967)
Madison River below Ennis Lake	2,186	1,215	1,208	1,754(1971)	795(1934)
Missouri River at Toston	14,669	3,484	3,490	5,059(1975)	2,056(1937)
Missouri River at Fort Benton	24,749	4,999	5,015	8,526(1975)	2,450(1937)
Marias River near Chester	4,927	620	591	1,200(1951)	170(1941)
Musselshell River at Mosby	7,846	183	170	728(1975)	12(1961)
Missouri River at Culbertson	91 557	6,870	6,804	12,004(1975)	3,655(1941)

[a]Historical average annual flow adjusted to 1975 conditions.
[b]Years of maximum and minimum annual flows shown in parentheses

SOURCE: USGS Streamflow Records and Depleted Flow Study, USDI.

Surface water quality is generally excellent in the upper reaches of most tributaries. It is mostly a hard, calcium-bicarbonate type with moderate sulfate levels. Waters of the Redwater and Poplar Rivers in the Missouri-Poplar planning area are of poor quality and generally unsuitable for irrigation.

Water quality generally degrades in a downstream direction as various uses contribute substances which deteriorate the natural quality. These include sediment eroded from tilled, grazed, and logged areas, return flows from irrigation, mine tailings, saline seep, and industrial waste. The Musselshell River in particular becomes very salty and carries excessive sediment in the lower reaches.

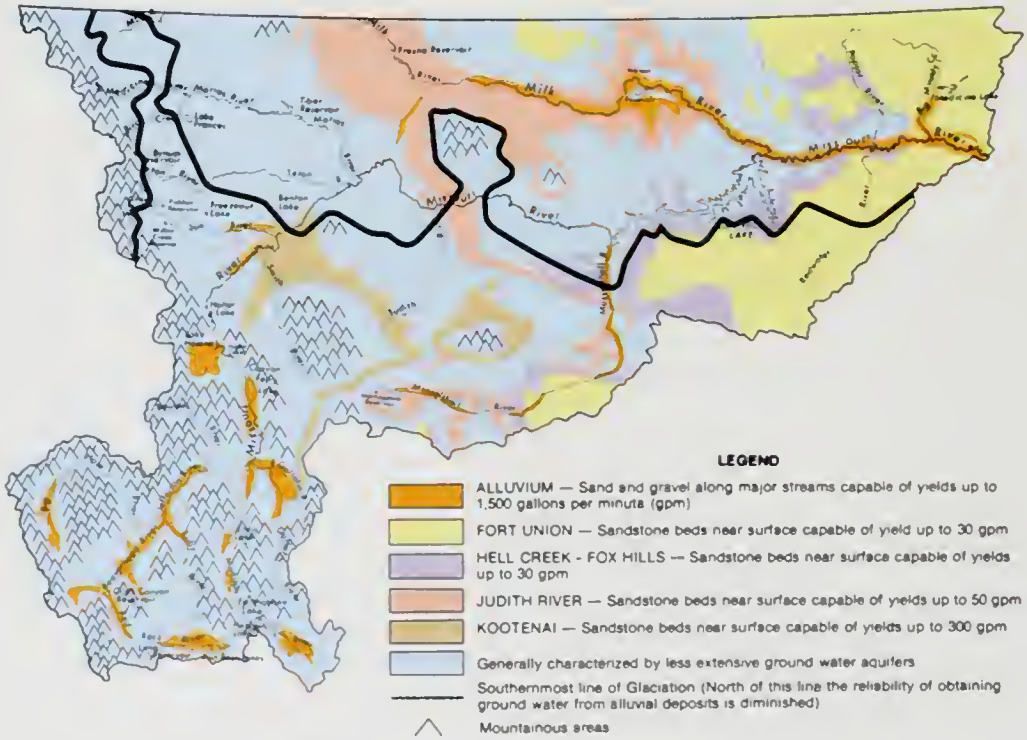
Ground Water

Ground water resources (Figure 10) comprise a significant portion of the total water resources. Both river alluvium and sedimentary formations, including coal, are ground water storage reservoirs, In the Upper Missouri Tributaries and Missouri-Marias planning areas, the principal water bearing formations are the river alluviums. Valley alluviums of the Big Hole, Jefferson, Madison, and particularly the Gallatin around Bozeman, yield up to 1,500 gallons per minute (gpm) of ground water. The Townsend and Helena valleys are also underlain by alluvial deposits and produce appreciable quantities of ground water. The Milk River and Missouri River below Fort Peck Dam have extensive alluvial deposits adjacent to their stream courses.

Most of the area north of the Missouri River as far west as the mountain front has been modified by glaciation. Glacial deposits in the valleys and plains are usually less permeable than alluvium. However, glacial outwash and deep glacial channels often yield large supplies of ground water.

The Kootenai Formation sandstones, exposed along the northern mountain flanks of the Little Belt and Big Snowy Mountains, extend out from these mountains for some distance. This formation is capable of yielding as much as 300 gpm.

Figure 10
MAJOR AQUIFERS



SOURCE "The Framework Report," Volume One Water Resources Division of Montana Department of Natural Resources and Conservation 1976 page 55

The Great Plains of northcentral and eastern Montana are underlain by aquifers such as the Fort Union, Hell Creek, Fox Hills, and Judith River Formations. On either side of the Milk River, sandstone in the Judith River Formation is capable of yielding 10-20 gpm.

The Madison Limestone, an extensive, deeper formation, outcrops in western Montana and the mountains of central Montana and has a potential for producing large quantities of water.

Water quality in these aquifers is locally variable. In most areas, ground water is readily obtainable, but in some areas along the Musselshell and the northern half of the study area, potable supplies of ground water are not available.

Resource Occurrence and Use

Topography, climate, and soils have a marked influence on the study area's resource distribution and use. Irrigated agriculture, dependent upon water availability and relatively level terrain, is found adjacent to streams and on level-to-sloping valley floors in mountain valleys where soils favor crop production. Longer growing seasons and wide expanses of level land favor large scale dry cropland farming in the northwestern and eastern part of the study area.

The relatively higher precipitation in the mountainous areas provides an adequate source of water to support continuous timber stands. Except for areas immediately adjacent to the larger rivers, these are the only forested areas in the Upper Missouri. These areas of pronounced topographic relief also offer recreational and wildlife benefits.

Water and Related Land Resources

Agriculture

Approximately 13.2 million[3] acres are devoted to crop production. This is 25 percent of the total land area and, in conjunction with livestock, accounted for 19 percent of the economic income for the subbasin in 1975.[4] Of the total area under crop production, approximately 10 percent is irrigated. Irrigated

Strip cropping in the central part of the Upper Missouri studs area

crops consist of wheat, alfalfa, hay, barley, corn, and oats. Wheat and barley account for the majority of dry cropland.

Most irrigated land is found along the Missouri tributaries, notably, the Big Hole, Jefferson, Madison, Gallatin, Sun, Teton, and Milk Rivers. The Toston, Townsend, and Helena valley areas receive irrigation water from the Missouri.

The two major grain producing areas consist of the "Golden Triangle" in the northwest part and an area in the northeast corner of the study area.

Improved irrigation techniques and recent high grain prices were partly responsible for the increase in irrigated land areas and conversion of range to dry cropland. Dry cropland expansion has stabilized in most areas, but irrigated cropland continues to increase, except in the Upper Missouri Tributaries planning area.

Livestock production, mainly beef cattle, has historically comprised about 50 percent of the total annual farm income. The study area has consistently contained about 54 percent of the cattle and calves in Montana. Hog and pig production has slowly shifted from other parts of Montana, with a 9 percent increase noted from 1960 to 1975. About 50 percent of the state's sheep and lambs are produced in the area. Milk cow numbers have been declining statewide, but the percent of the state's milk cows that are in the study area has increased slightly.

Forestry

Of the 7.3 million acres of forest lands in the area, 4.1 million acres are producing commercial timber products. Large areas of

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[3]Includes all cropland and irrigated pasture, Land and Water Conservation Measures technical paper

[4]Bureau of Economic Analysis, U S Department of Commerce, Unpublished data

federal lands producing commercial timber are found in the Beaverheads, the Highlands and the Little Belt Mountains. The majority of timber harvested comes from private lands.

Federal timber lands are managed by the Forest Service and Bureau of Land Management. The Blackfeet and Rocky Boy Indian Reservations also produce commercial timber products.

Mining

Gold, silver, copper, lead, iron, talc, manganese, uranium, gypsum, silica, and tungsten accounted for more than 95 percent of the area's past mineral yield. Some 947 operations have, or are currently producing, commercial quantities of gold, silver, lead, talc, copper, iron, silica, limestone, clays, gypsum, coal, mica, tungsten, sand and gravel, stone and gemstones.

More than 530,000 surface land acres overlie known natural gas resources; 355,000 acres are covered by mining districts and 217,800 acres overlie known petroleum resources. Producing oil and natural gas fields occur near Cut Bank, Havre, Poplar, Plentywood, Richey, Culbertson and Melstone. Oil refineries are located in Great Falls, Cut Bank, Kevin, and Wolf Point.

More than 183,500 acres have coal deposits extractable by surface mining methods. In the northeast portion, the Fort Union Formation contains most of the known coal reserves. These are not presently being mined extensively, but increasing energy demands could favor the extraction of this coal in the future.

Outdoor Recreation

Most of the recreational activities are associated with water. Streams and lakes supply needed water for boating, fishing, picnicking, and camping. Although recreation does not result in the consumption of significant amounts of water, many activities are dependent on, or enhanced by, the presence of water.

Boating is a major recreational pursuit on many of the larger reservoirs. Canyon Ferry Reservoir attracts motor boat enthusiasts from as far away as Billings. Despite its size, Fort Peck Reservoir is vastly under-utilized as a recreational resource. The distance from urban centers, lack of facilities, and difficulty of access discourage intensive use of this water body.

Mountainous areas offer opportunities for fishing, hunting, backpacking, camping, sightseeing, and winter sports. Several downhill ski areas are located in the study area. Two of these, Bridger Bowl and Big Sky, both near Bozeman, attract a quarter million skiers seasonally.

Hunting is the most popular form of recreation. However, hunting demand exceeds the available land area open for hunting in all but the northern and eastern planning areas. Lack of adequate land areas open to hunting is diminishing the quality of this form of recreation.

Four designated national natural landmarks are associated with streams in the area. They are: 1) Bug Creek Fossil Area in McCone County, 2) Hell Creek Fossil Area in Garfield County, 3) Middle Fork Canyon in Gallatin County, and 4) Red Rock Lakes National Wildlife Refuge in Beaverhead County.

Part of Great Falls float race on Missouri River.

Fish and Wildlife

Approximately 254 miles of the Missouri and its upper tributaries are classed as Blue Ribbon Trout Streams and are considered to

Whitetail deer are distributed throughout the basin

Another basin inhabitant - the Rocky Mountain goat

be of statewide as well as national significance.[3] Reservoirs in the north and east are productive walleye and northern pike fisheries.

Vegetation and wildlife go hand in hand. Suitable browse or grass is essential to the existence of the deer, elk, moose and antelope populations of the state. Similarly, riparian and wetland environments are necessary habitats for the majority of birds and waterfowl.

Although highly dependent upon the availability of water, fish and wildlife are minimal consumptive users. In addition to aquatic ecosystems, water-influenced terrestrial ecosystems are important to fish and wildlife. The riparian habitat, or zone, is that area influenced by a high water table and usually occurs adjacent to a water body. The riparian zone characteristically is an area of high diversity and productivity which provides all or some part of the habitat requirements of many fish and wildlife species.

Elk and mule deer often share similar habitats, the area's mountainous regions. Although elk are now mostly restricted to higher mountainous elevations, they once inhabited Montana's eastern plains and have been reintroduced to the Missouri River Breaks area.

Whitetailed deer, not as commonly seen as mule deer, are associated with deciduous, bottomland or riparian vegetation. Although the eastern half supports most of the whitetails, populations exist throughout the basin.

Antelope are found throughout the study area but primarily in the eastern two-thirds bounded by a line from Helena north to the Canadian border and east to North Dakota, with the exception of the mountain areas and the Missouri Breaks. Optimum antelope habitat consists of open, rolling, sagebrush-grasslands free of human development.

Moose are found primarily in the southwest part of the study area. The Missouri Tributaries planning area contains almost all of the available moose habitat, with the exception of the mountains south of Helena and Big Belt mountains east of Canyon Ferry Reservoir.

One of the more sought after big game animals is the bighorn sheep. Rocky ledges and walls interspersed with open slopes are the bighorn's habitat. The Sun River herd is the finest in the state. Bighorns are also found in the Gallatin, Madison, Red Rocks, Gates of the Mountains north of Helena, an area south of the Smith-Missouri River junction, and in the "Missouri Breaks" country in Fergus and Garfield Counties.

Rocky mountain goats' habitat is terrain similar to that of the bighorn sheep but occurs at higher elevations, from 5,000-11,000 feet. Successful transplants from western Montana have established goats in many of the study area's mountain ranges.

The black bear, found throughout the mountainous terrain is found in a variety of forest habitats ranging from open ponderosa pine to spruce fir forests. Although common, black bears are a popular big game animal.

In contrast, the grizzly bear is found in a few remote, forested regions in the study area. Populations exist in the alpine, heavily timbered areas of the Lewis Range, Glacier National Park, and the Madison Range-Yellowstone National Park area. The last huntable grizzly population in the contiguous

[3]Montana Department of Fish, Wildlife and Parks classification system

48 states is found in the northern Continental Divide area. Considered nationally a threatened species, the grizzly will continue to depend upon the existence of uninhabited, inaccessible wild areas.

The grizzly bear - found in remote, uninhabited areas.

Mountain lions are relatively solitary animals found most commonly in timbered, mountainous areas. Formerly considered a predator in Montana, the lion is now a game animal, huntable by permit.

Ten species of upland game birds occur in the study area. Native birds are white-tailed ptarmigan and spruce, ruffed, blue, sharp-tailed, and sage grouse. Introduced species include ring-necked pheasant, Hungarian and Chukar partridge, and Merriam's turkey.

Hungarian partridge and sharp-tailed and sage grouse are commonly found in the high plains of the eastern portion of the area. The sage grouse, although not as abundant as the sharp-tail, is found in the Big Hole and Beaverhead drainages of the Upper Missouri Tributaries planning area. Sharp-tailed grouse and Hungarian partridge favor a mixture of cultivated and noncultivated lands, while sage grouse depend on sage for survival.

Forest grouse (blue, ruffed and spruce) are native to mountainous areas. However, spruce grouse are not found in the isolated eastern ranges as are the other two species.

Pheasants are presently found along most of the major river drainages associated with irrigated grain production. Major populations exist west of Lewistown and north and southwest of Poplar.

Successful transplants of turkeys have resulted in their distribution around Helena, Great Falls, Lewistown, Roundup,, and north along the Musselshell River and Missouri Breaks. Open ponderosa pine forests and rugged terrain are their favored habitat.

Important migrating birds include 2 species of swan, 5 of geese, 3 of mergansers and 23 duck species. A few ducks, mostly mallards and goldeneye, winter in the state on open water. Only the Canada goose winters in Montana. Duck and geese use small stock ponds, glacial lakes, rivers, and reservoirs for nesting. Swans and sandhill cranes nest in the Red Rocks drainage. The Bowdoin National Wildlife Refuge near Malta, the Medicine Lake National Wildlife Refuge near Medicine Lake and Freezeout Lake near Fairfield are important goose-breeding grounds. Duck populations in the northern, glaciated prairies in the eastern portion of the study area compare favorably with the best waterfowl breeding range in the continent.

Furbearers include: beaver, marten, mink, muskrat, otter, fisher, coyote, weasel, skunk, raccoon, badger, bobcat, jackrabbit, red fox, lynx and wolverine.

Beaver, bobcat, coyote, muskrat and mink are highly valued by trappers and are distributed throughout the study area. The river otter, also trapper's game, is found along most of the main river courses in the study area.

Bobcats, along with their prey of rabbits and rodents, are widely distributed, as are weasels. Wolverines have been infrequently reported in timbered, mountainous regions.

Socio-Economic Characteristics

Historical Development

The area now known as Montana provided the stage for repeated Indian settlement and invasion before the advent of the white man. Archeological and historical accounts from explorers and trappers supplied important information on Indian history of the state.

Approximately ten tribes at various times occupied portions of the present state of Montana. Of these, at least eight lived in the study area. Not a single tribe presently east of the Continental Divide was there before 1600; most were Eastern tribes pushed west by other eastern tribes and American settlers.

Two Indian groups, no longer resident, were the Kootenai and Pend-d-Oreille. The plains Kutenai were centered in Alberta and extended their range into northcentral Mon-

tana. The Pend-d-Oreille were divided into two groups, one of which was located in the Sun River valley, west of Great Falls. A third group, the Flathead Indians, lived in the Three Forks-Bozeman valley area and ranged as far east as the Big Horn Mountains. All three tribes were forced west of the Continental Divide by incursions of the Shoshoni, and later, the Blackfeet. The Blackfeet tribe, originally located in the Great Lakes region in Canada, advanced into northern Montana around 1800. They were militant and occupied most of northcentral Montana, extending their territory as far south as Three Forks. Today they live on the Blackfeet Reservation in Glacier County.

The Assiniboine, originally found north of Lake Superior, migrated into Montana in the late 1700's. They presently share the Fort Belknap and Fort Peck Reservations with the Gros Ventre and Sioux, respectively.

The Chippewa was one of the last groups to enter Montana and settled on the Rocky Boy Reservation in Hill County in 1908. Here they settled with the Cree, also "landless Indians," who had fled Canada because of dissatisfaction with treaty arrangements.

Meriwether Lewis and William Clark explored the Missouri and its headwaters in 1805 and 1806 following the Louisiana Purchase. Fur trading dominated the economy until the 1850's when gold was discovered. Railroad construction opened the way for general development of Montana's mineral, lumber, and livestock industry. In 1864, the Montana Territory was formed with its capital at Bannack. Helena and Virginia City became mining centers. Cattle ranching attracted investment and large herds were headquartered in the Beaverhead, Gallatin, Sun River, and Musselshell valleys and Judith Basin. The Beaverhead and Musselshell valleys as well as Judith Basin also became prosperous sheep raising centers. Major Indian battles, notably the surrender of Chief Joseph and his band of Nez Perce Indians in the Bearpaw Mountains in 1877, ended the era of relative Indian freedom and resulted in their forced settlement on reservations.

Homesteading followed railroad construction on the Upper Missouri eastern plains. Montana was admitted to statehood in 1889. In 40 years, from 1860-1900, Montana's population increased from less than 100 whites to over 240,000 people. Many of these were attracted as homesteaders. From the turn of the century until the 1930's, agricultural interests dominated the economic sector of Montana. Part of this was stimulated by the formation of the Federal Bureau of Reclamation and the completion of several irrigation projects by early 1950.

After World War II, industrial developments stimulated urban expansion, particularly in Great Falls. Oil discoveries in the eastern part of the study area supplied an important source of state revenue during the 1950's. As previously mentioned, agriculture still dominates the economy, with 60-80 percent of the state production of hay and small grains coming from the study area. Manufacturing, oil and gas production, lumbering and mining account for the remaining major industries in the study area.

Population and Education

The study area population has increased from about 255,000 in 1950 to over 313,000 in 1975 (Table 4). However, the state population has grown slightly faster, thus decreasing the percentage of population living in the study area. Even though the study area

TABLE 4
POPULATION OF PLANNING AREA

Planning Area	1950[a]	1960[a]	1970[a]	1975[b]
Upper Missouri Tributaries	38,585	42,747	50,944	58,100
Missouri-Marias	121,858	151,233	157,914	164,600
Missouri-Musselshell	30,345	29,095	24,943	25,600
Milk	40,488	49,851	40,942	43,300
Missouri-Poplar	23,458	25,265	22,102	21,500
Upper Missouri Study Area	254,734	298,191	296,845	313,100
Percent of State	43.1	44.2	42.8	42.0

[a]Source **The U.S. Census of Population,** U.S. Bureau of the Census for the appropriate year
[b]Source **Estimates of the Population of Montana Counties and Metropolitan Areas:** July 1, 1975 (Revised) and 1976 (Provisions) U.S. Bureau of the Census, P-26 No. 76-26, July, 1977

covers more than 50 percent of Montana, its population accounts for only 42 percent of the state.

Two planning areas have had population declines since 1950. These areas (Missouri-Musselshell and Missouri-Poplar) are predominantly rural and neither contains a population center larger than 8,000 people. Most of the growth in population has occurred in the Upper Missouri Tributaries and Missouri-Marias planning areas and primarily in Bozeman, Helena, and Great Falls. Most rural and isolated counties have either grown very little or lost population since 1950.

About 5 percent of the study area's people in 1970 were American-Indians. In the Milk and Missouri-Poplar planning areas, over 10 percent of the population was American-Indian. The majority of these native Americans live on one of four reservations: Blackfeet, Fort Belknap, Fort Peck, and Rocky Boy's.

The educational levels of the American Indians are considerably lower than for non-Indians. Only 28 percent have completed high school as compared to over 62 percent of the white population.

Income and Employment Characteristics

The median and mean family incomes of white inhabitants in the study area compare quite favorably with the rest of the state but are below the national level. Over 72,000 families had a median income of approximately $8,700 and mean yearly income of approximately $9,900. The average Indian family income is only two-thirds that of the white family. Over 62 percent of American Indian families have annual incomes less than $6,000, while only 27.8 percent of the white families receive less than $6,000 annually.

The percentages of personal income derived from various sectors for 1975 are shown in table 5. The farm sector was by far the most important individual sector during 1975. The fluctuations of farming income are largely due to price and production level variations.

Typical of American agriculture, the numbers of farms and ranches have been declining. Over the 20-year period from 1954 to 1974, the number of farms and ranches decreased by 25 percent, while the average size increased from just over 2,100 acres per unit in 1954 to over 2,900 in 1974. (Table 6).

TABLE 5
PERCENT OF INCOME BY SOURCE, 1975

Sector	Planning Area					Study Area
	1002	1003	1004	1005	1006	
			(Percent)			
Farm	7.8	16.1	27.4	27.4	42.7	19.1
Ag Services, Forestry, Fisheries & Other	.3[Da]	.1[D]	.3[D]	3.8	.2[D]	.6
Mining	.7[D]	1.1[D]	4.9[D]	.6	2.4[D]	1.3
Construction	4.7[D]	4.2	6.2[D]	5.2	1.1[D]	4.3
Manufacturing	5.0[D]	4.3	3.4[D]	2.1	1.1[D]	3.8
Trans., Comm & Public Utilities	4.4	5.8[D]	3.6[D]	9.4	5.6	6.0
Wholesale Trade	2.4[D]	4.8	2.9[D]	4.1	4.6	4.2
Retail Trade	10.5	8.0	9.1	8.8	6.7	8.4
Fin., Ins & Real Estate	3.0	3.4	2.3	2.6	1.4[D]	3.0
Services	10.1	10.0	6.3	9.4[D]	9.0	9.6
Federal Gov't.	5.0	11.0	3.8	6.1	3.9	8.6
State & Local Gov't	20.3	10.0	11.7	9.0	8.2	11.3
Unaccounted[b]	25.8	21.2	18.1	11.5	13.1	19.8
Total Income ($000)	244,202	1,021,227	102,064	226,938	126,874	1,721,305

[a]Due to nondisclosure policies of Bureau of Economic Analysis some data in some counties for the categories labeled "D" were suppressed; consequently, the actual percent for these sectors is understated.
[b]This includes the percent due to nondisclosure and other minor sectors.

SOURCE Bureau of Economic Analysis, U S Dept. of Commerce, Regional Economics Information System Unpublished data

TABLE 6
FARM SIZE AND VALUE OF PRODUCTION FOR MISSOURI RIVER BASIN IN MONTANA[a]

	1954	1959	1964	1969	1974
Number of Farms	17,140	15,355	14,484	13,668	12,851
Land In Farms (ac)	36,297,472	38,297,661	40,009,221	37,603,994	37,337,403
Average Farm Size (ac)	2,117.7	2,494.1	2,762.3	2,751.2	2,905.4
Total Value of All Ag. Products Sold ($1,000)	221,454	234,860	237,154	340,257	620,639

[a]From U.S. Bureau of Census, Census of Agriculture. Data for all farms.

The area is fairly well balanced between livestock and crop production and each account for about 50 percent of total value of agricultural products. Individual planning areas are not so evenly split between crop and livestock production. For example, in the Upper Missouri Tributaries planning area, livestock generates about three-fourths of the income value whereas in the Missouri-Poplar planning area, crops account for three-fourths of the value.

The study area is an important crop producer for the State of Montana. More than three-fourths of the state's wheat, barley, and flaxseed and over one-half of the state's hay and oats are grown in the Upper Missouri Basin. From 1960 to 1975 an average of over 5.5 percent of the nation's wheat and more than 10.5 percent of the nation's barley came from the study area.

Forestry is another important income source for some of the planning areas. Over the most recent 5-year period, the timber harvest has averaged about 140 million board feet per year.

Livestock raising - an important activity in the basin.

Federal and state government employment is relatively large in the Missouri-Marias planning area because of the existence of the military base in Great Falls and the state capital at Helena.

Unemployment has averaged 5.1 percent over the last 5 years. This compares to 5.8 percent statewide and 6.7 percent for the nation. While unemployment is not a major overall problem, the situation is quite different for the American Indian. In recent years their unemployment rate has been averaging about 45 percent. Although more Indians are now employed, the total labor force has also increased due partially to population growth and primarily to increasing participation rates.[6]

Transportation

The area's transportation system is limited and reflects the predominantly rural, sparsely settled nature. Since few highways and railroads cross the area in a north-south direction, the majority of travel is east to west.

There is an adequate network of approximately 44,000 miles of roads, including interstate, primary, secondary, and county highways and roads. A grid network of surfaced

[6]Based on data provided by the Bureau of Indian Affairs Department of the Interior.

and unsurfaced roads serves the rural eastern and northwest portions of the study area. Mountainous terrain in the southwest and badland topography in the central part, coupled with sparse settlement, limit roads and access in these areas.

A north-south interstate highway, I-15, links the towns of Dillon, Helena, Great Falls, and Shelby. Only one other north-south highway, from Roundup to Malta, crosses this area for any significant distance. Several relatively short federal and state highways provide north-south access for population centers. A short section of I-90 traverses the southern portion of the area and connects with I-15. Several highways traverse the area from east to west including U.S. 2, U.S. 12 and Montana 200.

Three railroads presently operate in the study area. These are the Burlington Northern, Union Pacific and the Chicago, Milwaukee, St. Paul and Pacific. The latter is in the process of abandoning its Montana services. The Burlington Northern has by far the most extensive rail network, serving the northern tier counties and Great Falls, Helena, and Bozeman areas. The Union Pacific serves only the Dillon area, running south into Idaho.

Great Falls, Helena, Bozeman, Lewistown, Havre, Glasgow, and Wolf Point are the only towns of any size with regularly scheduled air service. Airlines serving the area include Northwest Orient, Frontier, Western, and Big Sky. The southcentral portion, including White Sulphur Springs, Harlowton, and Roundup has no air service.

Laws and Policies Affecting Water and Land Related Resources

Regulations control and restrict the use of water. Many laws and policies have been enacted as the result of expressed need for regulation of specific actions affecting the states' water resources. Other laws indirectly affect water use by restricting land use activities adjacent to water bodies.

Before any project affecting water use can be started, a knowledge of those laws, policies and administrative procedures which could possibly constrain implementation is necessary to logically plan for project completion. This section presents a summary of laws, policies and administrative procedures most pertinent to resource actions considered in this study.

State Programs Affecting Water and Related Land Resources

Over 30 state laws pertain in some degree to water quality or quantity. Regulatory authority not reserved for the state is granted to local government bodies. Approximately one-third of these laws have direct significant impacts on water.

Montana State Capitol.

Agricultural Water Use

The Montana Water Use Act of 1973 (Title 89, ch. 8) requires that permits for appropriations of water after July, 1973 must be obtained by making application to the Department of Natural Resources and Conservation. If the request does not conflict with existing appropriations, the permit is approved.

In addition, any federal, state or local agency may apply to the Board of Natural Resources and Conservation for a water reservation for public benefit to maintain a minimum flow level or preserve a level of water quality. These agencies may also apply to reserve waters for consumptive uses such as municipal, domestic and irrigation.

The Water Use Act also governs the appropriation of ground water. Permits must be obtained from the Department prior to drilling any well with a planned capacity exceeding 100 gpm. If excessive withdrawals could deplete area aquifers, the Board of Natural Resources and Conservation may designate an area of controlled ground water use and grant permits to withdraw water based on an aquifer's capacity.

Senate Bill 76 requires that individuals claiming surface or ground water rights prior to 1973 must file a claim to that water with the Department by January 1, 1982. A

statewide water court system has been established with the appointment of four judges, each presiding over a district water court. Certificates of water rights will be issued after the water right claims have been adjudicated by a district water court judge. This adjudication process will formally establish those rights in existence prior to 1973.

Flood and Streambank Erosion Control

Under provisions of the Floodway Management Act (Title 89, Ch. 35) of 1971, all flood plains in the state must be delineated and regulations applied restricting land uses within this designated zone. Both the floodway (the area of highest flood velocities and depths) and the flood fringe (the area inundated by a 100-year frequency flood) are delineated. While most construction, under specific standards, is allowed in the flood fringe, septic tank systems are excluded. Only temporary and open-space uses are allowed in the floodway. After a flood plain has been delineated, local governing bodies have six months to adopt land use regulations and building permits. The Department of Natural Resources and Conservation enforces regulations if the governing body fails to do so.

Land Use Planning

Under the Major Facility Siting Act of 1973 (Title 70, Ch. 8), any major energy producing or energy using facility must apply for a certificate of environmental compatibility and public need from the Montana Department of Natural Resources and Conservation prior to its construction. Any major facility that would generate or transport electricity, gas, or liquid hydrocarbon is included. Others include facilities for the transport of water, enriching of uranium,, conversion of coal, use of geothermal resources, or in situ coal gasification.

The Board of Natural Resources and Conservation uses studies by the Department as a basis for granting, denying, or modifying the application.

Firms with existing facilities and those proposing additional construction must annually submit long-range plans to the Department.

The City and County Planning Enabling Act (Title 11, Ch. 38), 1957, authorizes the creation of city, county and city-county planning boards and their adoption of a master or comprehensive land use plan. Once such a plan is approved, the governing body of the jurisdictional area affected by the plan must seek advice of the planning boards to be sure proposed subdivisions conform with the plan.

Two laws, the Municipal Zoning (Title 11, Ch. 27), 1929, and County Zoning Enabling Acts (Title 11, Ch. 47), 1963, grant powers to the city council and county commissioners, respectively, to adopt zoning regulations. Under the provisions of these two acts, zoning districts may be delineated and regulations controlling development within the districts established. A board of adjustment may grant exceptions to regulations within each district.

Additionally, individuals, separately or as a group, may petition the county commissioners to form specific districts, usually governing rural residential development. Conversely, agricultural districts limiting or excluding residential development may be formed.

The Montana Subdivision and Platting Act (Title 11, Ch. 38), 1973, required land divisions containing parcels of 20 acres or less to conform to specific survey and platting procedures. Such plots must receive approval of the governing body and be filed with the clerk and recorder prior to any parcel sales. Exceptions to these procedures apply to an occasional sale of land parcels and the division of land among family members.

Land and Water Conservation

Several types of districts, including water and sewer, drainage, and irrigation, may be formed to use or control water These districts provide for flood control, irrigation water use, excess water drainage, and municipal water use. All are locally administered and are eligible to receive federal funding

Usually through petition, landowners form appropriate districts to manipulate surface water. A board of supervisors or commissioners is then formed and may appropriate water, construct water works, regulate water use, and receive federal or state funds. Most important, the board or commissioners may levy taxes or charge water users fees and issue bonds to retire any long-term indebtedness.

Under the Conservation Districts Law of 1939 (Sections 76-101 through 76-219), any ten occupiers of land lying within the limits of the area proposed to become a conservation district now may petition the Department of Natural Resources and Conservation to form a district. A conservation district is both corporate and politically governed by five supervisors appropriately elected. The districts are coordinated through the Department of Natural Resources and Conservation.

In addition to taxing authority, conservation districts are empowered to develop comprehensive district plans for soil and water conservation and flood control; to undertake demonstration projects; to construct, improve, and operate structures as may be necessary for authorized operations; and to conduct research on soil erosion, floods, and sedimentation.

Under the Renewable Resource Development Act of 1975 (Title 89, Ch. 36), ranchers and farmers are eligible to apply for funds to construct or improve dams and reservoirs for irrigation, stock watering, fish and wildlife, recreation, and sedimentation and erosion control. Grants or loans may be made from this fund to any state or local government agency for purchase, lease, or construction of projects for the conservation, development of the land, water, fish and wildlife, or other renewable state resources.

The Strip and Underground Mining and Reclamation Act and Strip and Underground Mining Siting Acts (Title 50, Ch. 10 and 16), regulate the siting of strip mining operations, exploratory and mining work, and reclamation of disturbed areas. Reclamation consists of restoring the disturbed land area to its former approximate contours, reestablishment of soil cover, and successful revegetation. A reclamation bond, filed before mining begins, is returned to the mining company if reclamation by the company is satisfactorily completed.

The Hardrock Mining Act (Title 50, Ch. 12), 1971, regulates reclamation of land disturbed by open pit and auger mining. Permits and reclamation guarantees are similar to those required of strip mine operators. "Small mines," or those which remove less than 36,500 tons yearly and disturb less than 5 acres, are exempt from the act's requirements.

According to the federal Surface Mining Control and Reclamation Act, lands and water within Montana are eligible for abandoned mine land reclamation activities if:

a) they were mined for coal or affected by coal mining processes;
b) they were mined prior to August 3, 1977, and left or abandoned in either an unreclaimed or inadequately reclaimed condition; and
c) there is no continuing responsibility for reclamation by the operator, permittee, or agent of the permittee under state or federal statutes as a result of bond forfeiture.

Lands and water which were mined or affected by mining for minerals and materials other than coal shall be eligible for reclamation activities under the State Reclamation Program. Many of these include active and inactive mines that are contributing to stream pollution because of acid mine drainage.

Work on the development of Montana's program commenced in August, 1979. An initial inventory of Abandoned Mine Lands information sources for Montana has been conducted and identified several areas in the study area.

Fish and Wildlife

The Montana Environmental Policy Act of 1971 is similar to the National Environmental Protection Act and provides that state agency actions which may significantly affect the quality of the human environment shall be preceded by an analysis and weighing of the environmental impact of such actions.

There are five elements that all environmental impact studies should address:

a) the positive impacts of the proposed action;
b) any adverse environmental effects that cannot be avoided if the project is implemented;
c) alternatives to the proposed action;
d) the relationship between local, short-term uses versus maintenance and enhancement of the long-term productivity; and
e) any irreversible and irretrievable commitment of resources which could occur if the project were completed.

The Stream Preservation Act and Natural Streambed and Land Preservation Acts (Title 26, Ch. 15), 1975, apply to public bodies and private individuals, respectively. Any project which could alter a stream or its banks must

receive prior approval from the local conservation district. These provisions do not apply to repair of existing irrigation projects.

Under the Lakeshore Protection Act (Title 89, Ch. 37), 1975, any proposed alteration of a natural lake bed must receive approval and a permit from the county commissioners. Such activities as dredging, lagooning, filling or dock construction in lakes are covered. Reservoirs are not included and lakes must be 20 acres or larger for the permit program to apply.

Outdoor Recreation

The Department of Fish, Wildlife and Parks administers land and water conservation funds provided by the Federal act of 1964. The Department reviews applications for outdoor recreation projects and approves and provides funding for their construction. To be eligible for funding, the recreation proposal must: a) be publicly sponsored, b) have 50 percent of the project costs locally funded, c) have effective land control, and d) be able to maintain and operate the proposed facilities.

Under the Antiquities Act of 1973 (Title 14, Ch. 563), heritage properties may be nominated to the National Register of Historic Places by state or local agencies or private individuals. Heritage properties include any district, site, building, or object of historical, architectural, archeological, or cultural significance. A preservation and review board established in the Montana Historical Society approves or disapproves all nominations. A historic preservation officer conducts a statewide survey of potential sites and formally nominates potential register properties.

Areas nominated and approved on state landholdings are provided with protection. Areas on private lands must receive landowner approval for state nomination and approval. No person may excavate, remove or restore any heritage property without first obtaining an antiquities permit from the preservation officer.

Water Quality

Under the authority of the Water Quality Act of 1967 (Title 60, Ch. 48), the Montana Department of Health and Environmental Sciences, through its Board, establishes water quality standards for all state waters. The Department administers a permit program, known as the Montana Pollution Discharge and Elimination System, requiring certain effluent standards to be met prior to the discharge of any treated water into any surface water drainage. This law regulates the discharge of all point source pollutants and includes the drainage of any saline seep areas. A permit is required prior to the construction or use of any outlet that discharges into surface waters. The Department may prevent or control pollution by issuing compliance orders or initiating civil actions to remedy the pollution problem.

In addition, the Department allocates state and federal funds to local entities for the construction or update of water pollution control facilities.

The Statewide Water Quality Management Program, commonly referred to as the 208 plan, requires that waste treatment controls be developed to regulate the source and amount of point and nonpoint source wastewater entering the state's water. The Water Quality Bureau(WQB) within the Department of Health and Environmental Sciences, and selected Areawide Planning Organizations (APO) were designated and funded to develop water quality control programs throughout Montana. The Blue Ribbons of the Big Sky APO, lying within the study area, comprising Gallatin and a portion of Madison Counties, has completed its program. The WQB has completed a water quality management plan for the remainder of the state.

A point source pollution control program has been established, but recently attention has been given to an equally comprehensive nonpoint source control program. This plan has recommended that agencies with land management responsibilities at the local, state, and federal levels integrate water quality management considerations into their present programs. Each agency within its jurisdiction will be responsible for identifying nonpoint source water pollution problems, and setting and working towards specific target dates for problem correction.

Several government entities are entering into management agreements with the Water Quality Bureau as a part of the implementation phase of the plan. The Department of Natural Resources and Conservation and local conservation districts will cooperatively develop and execute a nonregulatory agricultural nonpoint source pollution control program. A second management agreement has been negotiated with the U.S.

Forest Service to implement a similar silvicultural nonpoint source pollution control program on national forest lands. A third management agreement has been completed with the U.S. Bureau of Land Management to implement plan recommendations on land under its control.

The Sanitation in Subdivision Act of 1967 (Title 69, Ch. 50) requires that sanitary restrictions be lifted by the Department of Health and Environmental Sciences before any house building can occur on subdivided land parcels. Required information includes lot size, topology, hydrology, and type of facilities. The Department will issue an approval certificate when satisfied that water pollution will not occur and water quantity is adequate. Unless this certificate is issued, no lots under 20 acres in size can be sold in any platted subdivision.

The Public Water Supply Act (Title 69, Ch. 49) 1967, amended 1979, gives the Board of Health and Environmental Sciences general supervision over all state waters which are directly or indirectly being used for a public water supply or for domestic purposes. The Department is empowered to investigate any alleged pollution of a water supply and may prohibit, through court injunction, the continuance of the pollution by ordering removal of the cause.

Federal Programs Affecting Water Use

Federal programs, in the form of technical assistance and cost-sharing, are designed to carry out large scale construction and land acquisition projects impossible for state and local entities to finance. These programs can be generally grouped into those promoting natural resource enhancement and those promoting water development of economic significance to a specified area.

Agricultural Water Use

Several federal programs are available to local organizations for assistance and funding to use water for agricultural purposes, primarily for irrigation projects.

Under the Reclamation Act of 1902, the Water and Power Resources Service assists state and local governments by stimulating local and regional economies through reclamation projects. These provide for some or all of the following purposes: irrigation water service, municipal and industrial water supply, electric power generation, water quality improvement, fish and wildlife enhancement, outdoor recreation, flood control, navigation, river regulation and control, and related uses.

Each reclamation project is authorized for construction by Congress on the basis of detailed appraisal and planning reports demonstrating engineering, economic, and financial feasibility. Appraisal studies provide initial information to determine the feasibility level.

Upon completion of an irrigation project, the Service usually operates the project for ten years, after which the project may be turned over to the local sponsoring entity, usually an irrigation district, for operation and maintenance.

Irrigation water from a federal reclamation project can be delivered to irrigable lands, limited to 160 acres in the ownership of a single person or entity, or 320 acres in the ownership of husband and wife.

The Small Reclamation Projects Loan Act of 1956 provides authority for loans and grants to irrigation and conservancy districts and other eligible entities to help finance, rehabilitate and expand water resource projects such as irrigation, flood control, water supply for domestic, industrial or municipal purposes, power, outdoor recreation, and fish and wildlife. The maximum allowable total project under this Act is limited to $25.5 million (1977 prices).

The Rehabilitation and Betterment Act of 1949 provides funds to irrigation districts and other projects eligible under the Small Reclamation Projects Loan Act for the repair, replacement or improvement of irrigation structures and systems which have deteriorated.

Indian Water Rights

An Indian water right arises under federal law. In nearly all cases, it comes into being when a reservation is created, whether the act of creation is a treaty, an act of Congress, or an executive order, and it pertains to lands within the reservation. No diversion of water and application to beneficial use is necessary for the creation of an Indian water right. The priority rules of appropriation law do not apply to Indian water rights. Ordinary appropriation rights date their priority from the time of use or date of permit; Indian water rights have priority at least from the date the Indian reservation was established.

The irrigation of Indian lands was authorized by the General Allotment Act of February 8, 1887, which provided that the Secretary of Interior should make a just and equal distribution of the available water among the Indians. Specific authorizations for irrigation development on Indian reservations have been provided by Congress for many projects in the Missouri River Basin.

Winters Doctrine—The legal principles governing Indian water rights and the reasons behind them were upheld by the U.S. Supreme Court in the case of Winters vs. the United States—the case that remains the foundation for establishing Indian water rights. The Court upheld the tribal claims and recognized the right of the United States Government to reserve water for future reservation use.

The Bureau of Indian Affairs is responsible for administration of Indian lands and water on four Indian reservations within the study area. The Indians on each of the reservations have claim to the use of the waters which are located on, or which flow through or along the boundaries of, the Indian reservation.

Four acts provide authority for construction and management of irrigation projects on these reservations. The acts and the reservations these apply to are: Blackfeet, March 1, 1907 (34 Stat. 1035); Fort Belknap April 30, 1908 (35 Stat. 558); Fort Peck, May 30, 1908 (35 Stat. 558) and Rocky Boy's, November 2, 1921 (42 Stat. 208).

International Agreements

The Boundary Waters Treaty of 1909, between the United States and Great Britain provides for the division of the waters of the St. Mary and Milk Rivers and the international tributaries of the Milk River between the United States and Canada. The original treaty gave the United States 500 cubic feet per second (cfs), or 75 percent of the Milk River flow during the irrigation season, April 1 through October 31. Canada was given 75 percent of the St. Mary River flows. This treaty was amended in 1921 to give the United States 75 percent of the Milk River flow up to 666 cfs with any volume greater than that to be divided equally.

The Boundary Waters Treaty provided for a coordinated framework to consider water allocation, appropriation and pollution control between Canada and the United States. This International Joint Commission is presently endeavoring to resolve problems and concerns regarding the uses of the Poplar River

Flood and Streambank Erosion Control

Under Section 205 of the Flood Control Act of 1948, the Corps of Engineers may fund and complete small flood control projects. Projects such as levees, floodwalls, and small dams are established practices the Corps undertakes to minimize flood losses, primarily in residential areas The federal share for each project may not exceed two million dollars, except in major disaster areas.

Section 14, 1946 Flood Control Act as amended, provides for emergency bank protection to prevent damage to adjacent structures endangered by bank erosion. Aid can consist of construction, repair, restoration, or modification of emergency streambank or shoreline protection works. As much as $250,000 can be spent on a single project.

The Watershed Protection and Flood Prevention Act of 1954 (P.L. 83-566) authorizes the Soil Conservation Service to plan for and assist in financing projects for control and use of water in watersheds not exceeding 250,000 acres. Project purposes may include flood prevention, drainage, irrigation, water supply, streamflow regulation, fish and wildlife, recreation, and municipal and industrial water supply.

The Flood Disaster Protection Act of 1973 requires flood insurance and regulation, mandatory in those communities where special flood hazard areas have been identified, if those communities and property owners wish to remain eligible for federal flood disaster assistance of insured loans.

The National Flood Insurance Act of 1968 requires communities desiring flood insurance to regulate future development in the flood plain.

The Water Resources Development Act of 1974 required federal agencies to consider nonstructural measures in planning flood control projects.

Authorized under Section 206, 1960 Flood Control Act, the Corps of Engineers' Flood Plain Management Services program assists state and local governments in efforts to effect regulation of flood plain development.

On request, the Corps provides technical assistance and guidance to governmental bodies and others for interpretation and application of existing flood data, or development of data on the extent, depth and frequency of flooding. The Corps also assists in preparation of flood plain regulations and information on flood plain evacuation, flood forecasting, and flood-proofing. Similar aid is available to federal agencies and, to the extent of available data, to nongovernment organizations and individuals.

Executive Order 11988, Flood Plain Management, restricts federal activities which would induce or support unwise development, occupancy, or modification of flood plains.

The Water Resources Development Act of 1974, Section 32, authorized and directed the Secretary of the Army to establish and conduct a national streambank and erosion prevention and control demonstration program for a period of five fiscal years.

Section 55 of the same act authorizes the Corps of Engineers to provide technical and engineering assistance to nonfederal public interests in developing structural and nonstructural methods of preventing damages attributable to shore and streambank erosion.

Land and Water Conservation

The Soil Conservation and Domestic Allotment Act of 1936 (P.L. 46-1935) allows the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS) to provide technical and cost-sharing assistance for the application of soil and water conservation practices on private lands. The ASCS provides cost-sharing assistance through the Agricultural Conservation Program (ACP). The SCS provides technical assistance through the ACP and technical and cost-sharing assistance through the Great Plains Conservation Program and the Small Watershed Program. Land treatment items provided through P.L. 566, small watershed program, include erosion reduction, irrigation systems and agricultural water management, grazing systems and crop residue management. The SCS also conducts soil and snow surveys as useful information to private and public entities.

Under the Resource Conservation and Development (RC&D) program, SCS provides coordination, technical, and financial assistance to local governments for carrying out eligible land and water conservation measures having community benefits.

The Resource Conservation Act of 1977 authorizes USDA, cooperating with the state and local conservation districts, to outline a process to appraise and evaluate the soil and water resources and programs. Reports to Congress would occur at five-year increments.

The Water Bank Act, P.L. 91-559, of 1970 authorizes the Secretary of Agriculture to enter into ten-year agreements (with provision for renewal) with landowners and operators to prevent the loss of certain wetlands and enhance their value. The Water Bank Program is administered by the ASCS with technical assistance provided by SCS.

The Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976, authorizes the Forest Service to assess the forest and rangeland renewable resources and to develop a national renewable resource program for managing the national forest systems lands and programs.

The Cooperative Forestry Assistance Act of 1978 authorizes the Secretary of Agriculture to work through and in cooperation with the state foresters in implementing Federal programs affecting nonfederal forest lands and it is complementary to the Forest and Rangeland Renewable Resources Planning Act of 1974.

The Multiple-Use, Sustained-Yield Act of 1960 mandates the administration of national forests for outdoor recreation, range, timber, watershed, and fish and wildlife purposes. The law stresses multiple use management as well as sustained yield of forest products. The Federal Land Policy and Management Act decrees a similar range of activity in administration of the public lands.

Municipal, Industrial, and Rural Domestic Water Supply

There are several sources of funding for areas which are in need of water system facilities.

The Community Facility Loan and Grant Program, under the Farmers Home Administration (FmHA), provides assistance to communities with fewer than 10,000 residents.

The Department of Housing and Urban Development (HUD) assists both urban and rural areas in building water systems. This program is designed to assist low and moderate income areas.

Other sources of funding for water supply systems can be obtained through the Economic Development Administration (EDA).

The Safe Drinking Water Act of 1974 (P.L. 92-523) regulates all public water systems that regularly supply water to more than 24 people or that have more than 14 connections, and most underground fluid injection. All public water supplies must comply with EPA primary standards which limit the amount of health-related contaminants.

Fish and Wildlife

The Federal Aid in Wildlife Restoration Act of 1937 and the Federal Aid in Fish Restoration Act of 1950 authorize assistance to the states in the development of projects to restore and manage fish and wildlife populations and to preserve and improve sport fishing, hunting, and related activities.

The Fish and Wildlife Coordination Act of 1958 (P.L. 85-624) charged the Fish and Wildlife Service with investigating possible damages to fish and wildlife resources resulting from large-scale water projects and small watershed projects, and of recommending means and measures to reduce these damages, and to improve and develop such resources. Under that Act, fish and wildlife shall receive equal consideration with other project purposes. Mitigation measures and costs to offset damages to fish and wildlife must be considered in project planning, and: "...the project plan shall include such justifiable means and measures for wildlife purposes as the reporting agency finds should be adopted to obtain maximum overall project benefits."

The Endangered Species Act of 1973 (P.L. 93-205) requires that federal agencies ensure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of endangered or threatened species or result in the destruction or modification of habitat of such species which is determined by the Secretary of the Interior to be critical for its conservation.

The Sikes Act amended by Title II of 1974 (P.L. 93-452) provides for cooperative state-federal planning and execution of conservation and rehabilitation programs for fish and wildlife habitat improvement on the national forest and public domain lands.

Section 102(a) of the Federal Land Policy and Management Act of 1976 (P.L. 94-579) provides authority to manage and protect the quality of scenic, ecological, and environmental values on the public domain, to provide food and habitat for wildlife and domestic animals, and to provide for outdoor recreation and human occupancy.

The Wilderness Act of 1964 prohibits commercial enterprise and permanent roads within any wilderness area designated under the act.

Energy Water

The Federal Power Act of 1920, as amended, requires nonfederal entities who propose to construct a power or navigation facility to ensure a Federal Energy Regulatory Commission license prior to any construction which will affect (a) waters over which Congress has jurisdiction, or (b) public lands or reservations of the United States.

Title IV of the Public Utility Regulatory Policies Act of 1978 (P.L. 95-617) directs the Secretary of Energy to establish a loan program to encourage the development of small hydroelectric power projects at the site of existing dams which are not being used to generate electric power.

Outdoor Recreation

The Wild and Scenic Rivers Act of 1968 authorizes the Departments of the Interior (USDI) and Agriculture (USDA) to study certain selected rivers which possess outstanding wild, scenic, recreational, and other environmental characteristics.

Under this authority, the Heritage Conservation and Recreation Service, USDI, identifies rivers that exhibit potential for inclusion into the National Wild and Scenic Rivers System. The National Park Service, USDI, and the Forest Service, USDA, upon authorization by Congress would study the rivers for inclusion in the system.

The National Historic Preservation Act of 1966 recognizes a need for the preservation of the historical and cultural foundations through a National Register of Historic

Places, grants-in-aid for preservation of historic buildings, structures and objects, and review of all federally-funded or approved undertakings that may affect a property listed on or eligible for the Register.

The Land and Water Conservation Fund Act of 1964 provides financial assistance to states for planning, acquisition and development of outdoor recreation resources, and also for federal acquisition of lands and waters needed for national parks, forests and refuges.

The Archeological and Historic Preservation Act (P.L. 93-291) of 1974 provides funding to agencies for the recovery of archeological data on federal water resource projects in order to preserve and protect those sites.

The Federal Water Project Recreation Act (P.L. 89-72) of 1965 provides assistance for local participation and for the development of recreational facilities associated with federally-funded water projects.

Environmental Quality

In recent years Federal laws have been passed and regulations written in a comprehensive attempt to protect human health and welfare. This legislation includes the National Environmental Policy Act (NEPA), P.L. 91-190 as amended by P.L. 94-83, and specific legislation and regulation governing disposal of pollutants into any environmental media

NEPA requires that where Federal funds or property are involved, any significant Federal action including resource development must be accompanied by an Environmental Impact Statement (EIS). The EIS is an analysis and assessment of the impacts of the proposed action on the environment and is usually performed by the agency proposing the action. The Environmental Protection Agency is then responsible for review of the EIS and making recommendations concerning the project to the Council of Environmental Quality (CEQ). CEQ makes final recommendations on the proposal to the President.

Water Quality

The Federal Water Pollution Control Act Amendments of 1972 authorize the Environmental Protection Agency to restore and maintain the chemical, physical, and biological integrity of the nation's waters.

Section 208 of this act mandates the development and implementation of area-wide waste treatment management plans within each State. The purpose is to develop and implement adequate control measures for significant sources of water pollutants in each State.

Section 303 of this act mandates the adoption and implementation of water quality standards within each state.

Section 314 of this act provides authority of Federal financial assistance to States in order to control sources of pollution in lakes This is known as the "Lake Restoration Program."

Section 402 of the act provides authority for a "national pollutant discharge and elimination system" which requires a permit for the discharge of any pollutant (primarily point sources) into any body of water.

Section 404 of this act authorizes the Corps of Engineers to implement a permit system for the discharge of dredged fill material into bodies of water at specified disposal sites.

The Clean Water Act of 1977 reflects the same basic philosophy as the Federal Water Pollution Control Act but, in addition, provides a mechanism for technical and financial assistance from the SCS and ASCS in the application of agricultural best management practices for water quality improvement. The agricultural portion of this program is commonly referred to as the Rural Clean Water Program.

The Federal Surface Mining Control and Reclamation Act of 1977 mandates stringent controls over coal mining activities and provides for reclamation of lands disturbed by previous mining practices.

Title IV of the Act authorizes the Secretary of Agriculture, through SCS, to carry out the Rural Abandoned Mine Program (RAMP) to reclaim eligible rural lands. RAMP provides technical and financial assistance, through the SCS, to land users for the reclamation, conservation, and development of eligible abandoned coal-mined lands.

The act provides that fees shall be collected from all coal mining operations in a State and 50 percent of such monies be set aside in a State Abandoned Mine Land (AML) Reclamation Fund. The Federal act requires that Montana submit an Abandoned Mine

Land Reclamation Program to the Department of the Interior's Office of Surface Mining Reclamation and Enforcement should it want to have jurisdiction over the expenditure of Montana's AML funds on AML problem areas within the State. The Montana Department of State Lands has been designated by the Governor as the State agency to prepare Montana's AML program.

Air Quality

The Clean Air Act amendments of 1977 (P.L. 95-95 and 95-190) are the most recent of a series of attempts to ensure high air quality throughout the country. Specific portions of this legislation which affect the management of water and related land resources include: establishment of ambient air quality standards (Section 109); establishment of performance standards for new secondary sources (Section 111); establishment of national emission standards for hazardous air pollutants (Section 112); prevention, control, and abatement of air pollution from Federal government activities (Section 118); and prevention of significiant deterioration of air quality (Sections 160 to 169).

Land Resources

Several pieces of legislation govern use and disposal of toxic and harmful substances on or in association with land resources. The Resource Conservation and Recovery Act (P.L. 94-580) governs the disposal of hazardous and nonhazardous solid waste which can affect surface and ground water quality. The Federal Insecticide, Fungicide and Rodenticide Act (P.L. 94-109, 94-140) and the Tox Substances Control Act (P.L. 94-469) are designed to protect human health and welfare from specific substances or toxic compounds some of which have affected water resources in the past.

CHAPTER III

PRESENT USE AND FUTURE CONDITIONS

The planning process recognizes that without any of the actions being considered by this planning effort, the resource base and its use will continue to change with time. Some of the changes may resolve existing problems while others may create new ones. To properly address the issues, it was necessary to project what is expected to happen in the future without any of the actions contemplated by this plan. This look into the future was designated as the Future Without A Plan (FWO) condition.

The FWO provides a means for identifying expected future problems as well as existing problems that are expected to continue. Another major role of the FWO is to provide a base line for evaluation of the impacts of plan components. For example, if the projected FWO shows that outdoor recreation needs will be met, the plan will not have to specifically address that function.

In this chapter, the present use and projections for each resource element analyzed are discussed, along with a brief assessment of the FWO condition. This provides an estimate of the remaining needs or opportunities to be addressed in plan formulation.

Land Resources

The Upper Missouri River Basin is semi-arid and supports an agricultural economy. This region depends primarily upon farming, ranching, forestry, and mining activities.

A knowledge of these land activities and their water requirements is used to project future trends. Since no modifications of existing programs were assumed, the remaining water and land use needs will provide a basis for future program modifications.

Land Ownership and Use

Present

Over 70 percent of the land area is privately owned and devoted primarily to grazing and agricultural crop production. Approximately one-fourth of the area (27 percent) is under public ownership and is administered by the U.S. Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service. Table 7 shows land ownership by planning area.

Table 7
LAND OWNERSHIP

Category	Planning Area 1002	1003	1004	1005	1006	Study Area Total[a]
			(1,000 acres)			
Nonfederal	4,025	11,787	8,681	7,983	4,903	37,379[b]
National Forest	3,310	2,615	234	--	--	5,159
Other Federal	1,144	895	1,783	3,145	300	7,267[c]
Subtotal	8,479	15,297	10,698	11,128	5,203	50,805[d]

[a] 1974 Census of Agriculture
[b] Includes 2,677,000 acres Indian lands
[c] Includes 5,506,000 acres BLM, 234,608 acres WPRS, 1,049,328 acres FWS, 477,420 acres NPS
[d] Includes only 29 county area included in WRC economic regions

SOURCE: Land & Water Conservation Measures Technical Paper

Table 8
CURRENT LAND USE — 1975

Planning Area	Irrigated Crop and Pasture	Dryland Crop	Range Dry Pasture and Barren	Forested Comm.	Forested Noncomm.	Other[a]	Total[b]
Upper Missouri Tributaries	583	349	4,276	1,669	1,357	245	8,479
Missouri-Marias	476	4,694	6,356	1,584	1,466	721	15,297
Missouri-Musselshell	140	1,506	7,555	732	279	486	10,698
Milk	209	2,716	7,381	131	78	613	11,128
Missouri-Poplar	51	2,498	2,507	12	3	132	5,203
Study Area Total[c]	1,459 (79)	11,763 (444)	28,075 (1,938)	4,128 (86)	3,183 (100)	2,197 (30)	50,805 (2,677)

[a]This includes wildlife refuges administered by the FWS and NPS administered lands.
[c]1974 Census of Agriculture.
[c]Numbers in parentheses are Indian lands.
SOURCE: Land & Water Conservation Measures Technical Paper

Rangeland accounts for approximately half of the study area's land base; 20 percent is under crop production and another 15 percent is forested. Table 8 lists the major land use categories by planning areas.

The Forest Service and Bureau of Land Management administers the largest land blocks in the study area, approximately 6.1 and 5.5 million acres, respectively. Approximately one-third (2.1 million acres) of the Forest Service land is managed as commercial forest, only a fraction of which is actively cut each year. The remainder is available for recreation, mining, and grazing. In contrast, approximately 80 percent of the state and privately owned forested areas, or 1.6 million acres, is used as commercial forest. Approximately two-thirds of the total timber production in the study area is from these land areas.

Most Bureau of Land Management lands are leased to ranchers for grazing. Fish and Wildlife Service lands are administered almost exclusively as wildlife refuges.

Future

Little overall change in land ownership is expected in the future. There will be minor shifts in localized areas as uses change but little change is expected in the public versus private land ownership percentage.

Changes in land use are expected to continue with the greatest change likely being the shift from agricultural to urban or subdivision. Other minor shifts may occur from agricultural to industrial and agricultural to recreation or wildlife. One other potential factor which could contribute significantly to land use changes is economic stability. If conditions are conducive, changes from dryland to irrigated agriculture and rangeland to dryland crops will likely occur.

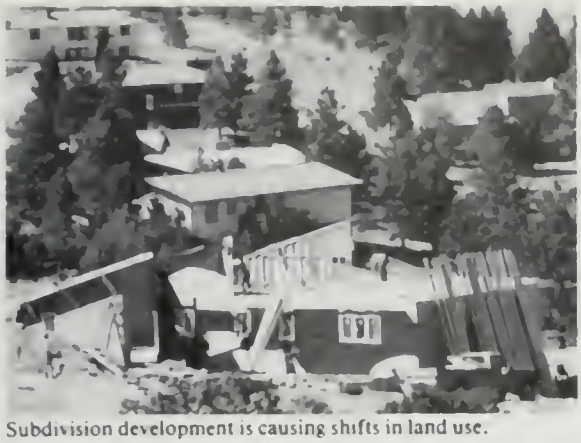
Agricultural Production Trends

Agricultural products in this study refers to dryland and irrigated crops, livestock, and commercial timber produced on both public and private land. Yield and acreage projection figures for these commodities were based on state, county, and national statistics.

OBERS

A series of nationally-based demand projections were used in the agricultural production portion of the study. These projections are referred to as OBERS[1] and were developed because of a need for projections that covered the nation by area on a comparable basis.

[1]An acronym that stands for Office of Business Economics (OBE), (now Bureau of Economic Analysis, U.S. Department of Commerce) and Economic Research Service (ERS), (now Economics, Statistics and Cooperatives Service, U.S. Department of Agriculture).



Subdivision development is causing shifts in land use.

OBERS projects are "in no sense a goal, an assigned share, or a constraint on a region's economic activity. They carry no connotation as to desirability or undesirability.[2] In this study the OBERS projections were used to give a general indication of future opportunities for agricultural development. They in no way constrained projects considered in the planning process.

[2]U.S. Water Resources Council, OBERS Projections, Vol. 1, 1972.

Crop Production

Present

Crop production varies significantly between the planning areas. The Missouri-Marias is the largest producer of small grains while the Upper Missouri Tributaries is the largest hay producer. The Missouri-Poplar produces large quantities of small grains but relatively small amounts of hay. Irrigation is of minor importance in terms of harvested acres in three of the five areas. Only in the Upper Missouri Tributaries does the number of harvested irrigated acres exceed nonirrigated.

The production of several major crops for five-year intervals from 1960-1975 is shown in table 9, along with the percentage of the total state production for the various crops.

Future

All irrigated and dry cropland yields are projected to increase within the study area

Table 9
PRODUCTION AND HARVESTED ACRES OF CROPS IN STUDY AREA, 1960-1975

		1960		1965		1970		1975	
Crop	Unit	Harvested Acres	Production	Harvested Acres	Production	Harvested Acres	Production	Harvested Acres	Production
All Wheat	Bu.	3,110,100	64,759,000	3,324,000	88,162,500	2,697,900	67,846,300	4,047,100	128,389,696
% of State			81.6		83.7		79.6		82.3
All Barley	Bu.	1,412,200	33,639,800	1,061,000	41,538,300	1,453,900	56,357,200	1,049,400	41,095,000
% of State			84.0		83.0		86.5		81.0
All Oats	Bu.	154,000	4,208,900	144,800	5,984,900	310,400	13,251,900	162,100	6,665,200
% of State			55.9		62.3		73.7		62.0
All Flaxseed	Bu.	29,400	202,900	15,400	192,800	32,700	358,200	11,300	88,100
% of State			89.0		77.1		81.4		78.7
Sugar Beets	Ton	5,640	60,800	3,920	31,500	3,500	40,800	2,500	34,150
% of State			7.2		4.2		4.4		4.1
All Corn Grain	Bu.	700	14,000	500	20,000	0	0	700	24,200
% of State			9.7		11.9		0		3.3
All Corn Silage	Ton	14,000	94,240	8,700	94,350	9,400	108,900	14,200	216,800
% of State			18.8		16.5		16.9		18.8
Alfalfa Hay	Ton	495,700	932,735	578,800	1,168,235	660,500	1,440,252	701,300	1,683,000
% of State			52.6		54.4		57.7		59.5
Other Hay	Ton	804,800	669,365	867,700	1,022,525	828,600	937,958	705,300	915,144
% of State			60.4		61.1		57.7		57.8
Total Harvested		6,026,540		6,004,820		5,996,900		6,696,415[a]	

[a]Total contains 2,515 acres of other crops not listed separately.

SOURCE: Montana Agricultural Statistics, Montana Department of Agriculture and U.S. Department of Agriculture.

Windrowing alfalfa on East Bench Irrigation Project near Dillon.

under current production trends and improved technology. Yield projections were made on a harvested acre basis and not total cropland planted.

FWO projections assumed no change in cropping patterns because the Principles and Standards assume a constant price relationship.

Projected yields were compared to a weighted five-year running average known as a current, normalized yield. The comparison of these yields and total production for irrigated and dryland crops is shown in tables 10 and 11.

The projected levels of crop production indicated for the study area by OBERS is, in most cases, greater than those expected under the FWO. A comparison of the OBERS and FWO projections for several crops is shown in table 12.

Table 10
CURRENT NORMALIZED AND PROJECTED YIELDS, ACRES AND PRODUCTION FOR HARVESTED IRRIGATED CROPS IN STUDY AREA, WITHOUT PLAN CONDITIONS

Crop	Units for Yield and Production	Current Normalized			Without Plan 2000		
		Acres	Yield	Production	Acres	Yield	Production
Winter Wheat	Bushels	14,770	54.8	810,000	15,560	65.4	1,017,000
Spring Wheat	Bushels	21,205	42.5	901,000	23,980	52.7	1,264,000
Barley	Bushels	92,860	58.9	5,469,000	103,960	74.1	7,706,000
Oats	Bushels	19,790	57.4	1,136,000	24,895	66.2	1,648,000
Alfalfa Hay	Tons	443,075	2.8	1,228,000	514,850	3.2	1,637,000
Other Hay	Tons	362,330	1.5	556,000	400,120	2.0	809,000
Corn for Silage	Tons	9,970	16.3	163,000	12,635	19.1	242,000
Total Harvested		964,000			1,096,000		

SOURCE: Socio-Economic Characteristics and Projections Technical Paper

Table 11
CURRENT NORMALIZED AND PROJECTED YIELDS, ACRES AND PRODUCTION FOR HARVESTED NONIRRIGATED CROPS IN STUDY AREA, WITHOUT PLAN CONDITIONS

Crop	Units for Yield and Production	Current Normalized			Without Plan 2000		
		Acres	Yield	Production	Acres	Yield	Production
Winter Wheat	Bushels	1,651,420	31.5	51,995,000	1,893,930	37.9	71,866,000
Durum Wheat	Bushels	211,060	27.3	5,760,000	246,250	28.9	7,127,000
Other Spring Wheat	Bushels	1,648,850	24.2	39,884,000	1,910,570	29.8	56,959,000
Barley	Bushels	1,208,500	37.0	44,680,000	1,381,810	43.5	60,177,000
Oats	Bushels	129,890	39.9	5,183,000	155,340	48.9	7,589,000
Alfalfa Hay	Tons	253,690	1.5	379,000	307,800	1.7	522,000
Other Hay	Tons	387,990	1.1	422,000	462,300	1.4	637,000
Total Harvested		5,491,400			6,358,000		

SOURCE: Socio-Economic Characteristics and Projections Technical Paper

Table 12
COMPARISON OF WITHOUT PLAN AND OBERS AGRICULTURAL PROJECTIONS IN STUDY AREA

	Unit	1990 OBERS	1990 Without Plan	2000 OBERS	2000 Without Plan
Crop					
All Wheat	Thousand Bushels	129,284 6	126,348	143,562 2	138,233
Barley	Thousand Bushels	82,419 1	62,350	97,639 9	67,883
Oats	Thousand Bushels	9,450.8	8,337	11,384 3	9,237
Corn Silage	Thousand Tons	222 1	215.0	261.7	242 0
All Hay	Thousand Tons	2,937 4	3,234.3	3,415.9	3,605.0
Timber	Million Board Feet	792 7	149.0	971 5	156 0
Livestock Products					
Beef and Veal	Thousand Pounds	838,990	652,095	956,400	677,954
Pork	Thousand Pounds	49,505	61,710	57,125	66,915
Lamb and Mutton	Thousand Pounds	7,785	14,315	6,695	11,900
Chickens	Thousand Pounds	1,825	1,715	1,425	1,500
Milk	Thousand Pounds	97,115	119,040	74,420	110,330

SOURCE: Socio-Economics Characteristics and Projections Technical Paper

Remaining Needs

Although no specific needs were shown for future agricultural crop production, the OBERS estimates indicate an opportunity for additional production above that expected from the FWO.

Livestock Production

Present

Livestock production is an important activity in the study area. Beef cattle are the most prevalent type of livestock produced. Livestock numbers for the 1960-75 period are shown in table 13.

Irrigated pasture and hayland residues provide significant animal unit months (AUM's) of forage. The majority of grazing occurs on public and private range and pasture lands, which provide over 7 million AUM's annually.

Future

Livestock production was projected to increase for beef, veal, and pork. Sheep, milk cows, and chickens were expected to show slight declines.

Future forage production in terms of AUM's was also estimated. Increased production was assumed using improved management as a tool.

Potential AUM's from grazing lands are projected to increase from 7.2 million to 9.0 million by 2000. The AUM's for irrigated pasture and cropland aftermath are projected to increase from 2.8 million to 3.5 million.

Projected OBERS production levels are less than the FWO for all livestock except beef and veal. Table 12 shows a comparison of FWO and OBERS for livestock production.

Table 13
LIVESTOCK NUMBERS

Year	All Cattle and Calves	Milk Cows and Heifers	Stock Sheep and Lambs	Hogs and Pigs	Chickens
1960	1,238,500	36,400	995,000	79,100	617,900
1965	1,539,200	27,600	786,800	86,400	520,300
1970	1,660,000	19,400	565,300	125,500	846,200
1975	1,806,000	12,100	327,200	88,200	612,700

SOURCE: Socio-Economic Characteristics and Projections Technical Paper

Remaining Needs

The fact that FWO production levels do not meet OBERS in all cases does not mean the plan is obligated to identify measures for additional production. It merely shows that an opportunity exists for expansion and the expansion will depend on specific economic and environmental analyses.

Log trucks with timber harvest.

Timber Production

Present

Timber is a harvestable crop and contributes to the area's economy. The Upper Missouri Tributaries and Missouri-Marias Planning Areas supply timber to mills, even supplying mills outside the study area. Total sales volume for these two areas was approximately $23 million in 1976. During 1973-77 an annual average of approximately 140 million board feet was cut in the study area.

Future

Under FWO plan conditions, the average timber production is expected to reach 156 million board feet by 2000.

OBERS projections indicate the study area share of timber market would be 971 million board feet by 2000. Again, this does not indicate a need, only an opportunity.

Mineral Production

Present

In terms of value, the major mineral commodities produced in the Upper Missouri River Basin during 1975 were petroleum, natural gas liquids, cement, sand and gravel, copper, gold, silver, lead, gypsum, talc, and silica. Common construction materials such as sand and gravel, stone, and clay are produced in most of the counties. The study area accounted for about five percent of Montana's production value of gold, silver, copper, lead, and zinc from 1910 to 1970. Over the past 20 years, the study area's mineral production value has declined relative to the state total. Table 14 provides information on the study area's present production estimates.

Future

The study area contains extensive rock units and geologic structures favorable for mineral resource exploration. More than 35 million acres have some potential for petroleum and natural gas; 27.5 million acres for metalliferous and industrial minerals; 16 million acres for coal recovery; 563,000 acres for oil shale occurrences; and 384,000 acres for uranium. No future projections of mineral production were made. Most potential mining activities would have a minimal impact on water use and quality but could have some impact on land use in small, localized areas.

Agricultural Water Use

Agricultural water uses are primarily for irrigation and livestock consumption. In the Upper Missouri study area approximately 1.5 million acres are irrigated. The principal crops grown on irrigated lands are hay, oats, barley, pasture, and beans. About 75 percent of the presently irrigated acreage is devoted to hay production. Irrigated oats, wheat, and barley account for approximately 10 percent of the total acreage.

Ground water is extensively used by rural water users for domestic and livestock use. One constraint in use of ground water is inadequate information regarding its occurrence. Other limitations include quality and economics of development.

Irrigation Water

Present

Irrigation is the largest consumptive user of surface water and accounts for about 80 percent of the total water used. Surface water diversions for irrigation occur on many streams with return flows providing a water supply for downstream irrigators and for other uses. During low flow years and in the

Table 14
AVERAGE MINERAL PRODUCTION ESTIMATES 1975
(Metals and Nonmetals)

	Short Tons	Value
Metals		
Gold silver, lead, copper	150,000[a]	$ 890,441
Iron ore	24 000	190,000
Nonmetals[b]		
Bentonite[c]	14 148	105,325
Cement	595,936	21,021,961
Gypsum	86,980	503,025
Limestone	750,000	2,250,000
Sand and gravel[d]	2,300,000	3,900,000
Silica	97,081	373,448
Talc	108,706	2,888,840

[a]Based on ore sold or treated, production average for UMRB from 1910 to 1975 State Dept of Revenue figure for tons extracted in 1975 totaled 93,640 tons

[b]With exception of sand and gravel, information compiled from report of the State Department of Revenue for period 7/1/74 to 6/30/76, page 90.

[c]Although production was nominal in 1975, new plants are now operating at Malta and Glasgow. The Malta plant is currently producing at the rate of 250,000 tons/year

[d]Estimated from population figures based on state per capita usage of 5.5 tons.

SOURCE: Report of the Montana State Department of Revenue, 1976, page 90, Bureau of Mines Mineral Yearbook

low runoff part of the season, diversions for irrigation have caused dewatering on several streams with a resultant adverse impact on the recreational and fishery resources.

Although some increase has been noted in recent years, use of ground water for irrigation in the Upper Missouri study area comprises only two percent of the total.

The majority of irrigation development has been completed by private companies and individual farmers. Of the total irrigated acreage, approximately 20 percent was planned and financed by the Water and Power Resources Service (formerly the Bureau of Reclamation). Eight storage and irrigation conveyance systems, constructed from the early 1900's to the late 1950's, irrigate 267,365 acres of cropland. No large federal projects are presently in final plans for construction. Irrigation projects have been developed by the Bureau of Indian Affairs to serve about 159,700 acres in the study area. At the present time, only 67,700 acres of Indian lands are being irrigated.

An abundance of cheap irrigation water has encouraged the practice of over-irrigation. This, coupled with inefficient irrigation systems and poor management, has resulted in large water losses and seasonal shortages on almost half of the irrigated acreage, often on streams where there are no storage facilities. Whereas, nearly 60 percent of the surface water in the study area is diverted for irrigation, only 20 percent of this is actually used by the crops.

Rising ground water levels have been observed in at least two locations in the study area. One of these is in Madison County where a 40-foot rise was noted from 1965 to 1974.[3] The cause is believed to be percolation losses from a surface water irrigation project.

Future

It is assumed that most of the future irrigation expansion will occur on lands whose soils, topography, and climate are capable of

[3]Ground Water Inventory Technical Paper

Table 15
IRRIGABLE LAND

Planning Area	Class 1	Class 2	Class 3	Total
		(acres)		
Upper Missouri Tributaries	4,301	121,134	615,069	740,504
Missouri-Marias	101,479	453,083	1,397,072	1,951,634
Missouri-Musselshell	7,153	563,568	1,017,821	1,588,542
Milk	30,720	317,450	1,212,902	1,561,072
Missouri-Poplar	50,692	453,239	1,033,191	1,537,122
Study Area	194,345	1,908,474	5,276,055	7,378,874

SOURCE: Montana Department of Natural Resources and Conservation, unpublished data.

Pumping plant on East Bench supplying sprinkler systems.

sustained irrigated agriculture. Irrigable lands are classified on the basis of their suitability for irrigation farming. Availability of water and development costs, while ultimately essential, have not been included as criteria. Class 1 represents lands with potentially high productive value; class 2 represents land of intermediate value; and class 3 includes land of the lowest productive value that may be considered suitable for irrigation. The irrigable lands for each of the planning areas are listed in table 15. The totals shown do not include those lands that are presently irrigated.

Under current trends, irrigation is projected to increase in the FWO from 1,459,000 acres to 1,591,000 acres by 2000. The only area expected to show a decrease in irrigated acres is the Upper Missouri Tributaries area, where a 41,000 acre loss is projected. This loss rate is based on current trends and may be lesser or greater. However, no obvious reasons were apparent to justify modifying the rate. The primary reasons for this decrease are subdivision development and retirement of marginal lands developed earlier.

The projected irrigated acreage increase of 132,000 acres under FWO represents a total irrigated land area increase of only 10 percent. A small increase in water use efficiency could supply water for the additional acreage. A continued improvement in irrigation systems and on-farm management under the FWO is expected to result in an overall irrigation efficiency of 27.5 percent by the year 2000.

The FWO assumes no development of any large scale state or federal projects. Most of the irrigated land increases will be completed by private companies or individuals, resulting in many small acreage increases by individual farmers.

The Milk River Diversion for the Fort Belknap Indian Reservation is currently being replaced. Funds of $1.7 million were provided for emergency replacement of the existing structure.

Remaining Needs

Almost half of the irrigated acres, or about 700,000, have supply shortages during the agricultural season. Improvements from activities expected in the FWO will reduce these shortages by about 25 percent. However, seasonal shortages will still occur on some systems.

Stockwater pond, typical of many in the study area.

Livestock Water

Present

Cattle and sheep represent the greatest livestock numbers and water users. Consumptive use rates of 12 gallons and 2 gallons per head per day for cattle and sheep, respectively, were multiplied by county livestock populations to estimate total consumptive use. Total livestock water depletion in 1975 amounted to about 24,000 acre-feet.

Approximately 50 percent of the livestock water is obtained from ground water supplies. In the extensively grazed areas of the north and east portions of the study area, several thousand stockwater impoundments on intermittent drainages supply livestock water. Because of the number of small reservoirs and their shallow depth, evaporation losses are high.

Present cattle and sheep numbers are approximately 2,140,000 head. Improvements in range forage use and range management will require additional reservoirs. Currently, reservoir densities range from one for every 900 acres in the Milk planning area to one for every 1,600 acres in the Missouri-Poplar area.

Future

Beef cattle and calves are estimated to increase within the planning period. FWO for the year 2000 calls for the construction of one reservoir for each 600 acres in the Missouri-Musselshell area, one for each 700 acres in the Missouri-Milk area, and one for each 1,000 acres in the Missouri-Poplar area. These should be constructed to impound not less than 10 acre-feet each to ensure adequate water supplies for dry years. These projected stockwater reservoirs and existing ground water supplies are anticipated to supply livestock needs within the planning period. Estimated present and future livestock depletions are shown in table 16.

Flood and Streambank Erosion Control

Flooding is usually a problem where flood plains are occupied by man or his activities. Streams form natural flood plains for use when runoff exceeds the channel capacity. The control of floods after man has inhabited and changed the flood plain is much more difficult to attain.

Table 16
LIVESTOCK WATER DEPLETIONS

Planning Area	1975	1990[a]	2000[a]
		(acre-feet per year)	
Upper Missouri Tribs	4,148	4,481	4,658
Missouri-Marias	4,831	5,272	5,480
Missouri-Musselshell	5,446	6,063	6,302
Milk (St. Mary's)	3,876	4,218	4,384
Missouri-Poplar	5,660	6,326	6,576
TOTAL STUDY AREA	23,961	26,360	27,400

[a]Planning area values approximated

SOURCE: Agricultural Water Technical Paper

Table 17
DAMAGES FOR JUNE FLOODS OF 1964 and 1975

Stream or Subbasin	Rural Damages 1964	Rural Damages 1975	Urban Damages 1964	Urban Damages 1975	Transportation 1964	Transportation 1975	Total 1964	Total 1975
Sun River	3,810	1,450	4,913	9,458	190	415	8,913	17,298[a]
Teton River	2,801	1,045	1,040	487	924	479	4,765	4,903[a]
Marias Subbasin	9,066	308	1,263		2,934	370	13,263	1,425[a]
Musselshell River		1,434		30		867		3,035[a]
Judith River		726		--		293		1,129[b]
Ten-Mile Creek		--		1,240				1,341[c]
Madison River		180		--		170		490[b]

[a]Includes damages for local, state and federal parks and flood recovery costs.
[b]Includes damages for local, state and federal parks.
[c]Includes flood recovery costs.

SOURCE: Flood Control and Erosion Technical Paper.

Flooding of West Great Falls during June 1975 flood.

Flood Damages

Present

Two recent floods of major magnitude occurred in 1964 and 1975. Both occurred during the month of June and resulted from heavy rainfall on top of a heavy snowpack. Damages from the 1964 flood were especially severe in the Sun and Marias River drainage areas. The 1975 flood inflicted heavy damages on the Sun, Teton, and Musselshell River drainages. The area sustaining the greatest monetary damage from flooding by the Sun River was the City of Great Falls. A summary of historic flood damages for 1964 and 1975 is shown in table 17.

Several measures have been installed which provide various degrees of flood control. One of the nation's largest reservoirs is Fort Peck, constructed on the Missouri River in the 1930's. Other reservoirs which provide flood control in addition to other beneficial features, include Elwell on the Marias River, Clark Canyon on the Beaverhead River, and Canyon Ferry on the Missouri.

In addition, several local protection projects have been constructed by the Corps of Engineers to provide flood protection for several communities. These include levees at Glasgow, Saco and Vaughn, and a levee and diversion project at Havre.

Small watershed projects have been constructed by the Soil Conservation Service under P.L. 566 at several locations in the study area. These projects provide some flood control protection. Among those in the Upper Missouri study area are the City of Shelby, Box Elder Creek, Beaver Creek, Big Spring Creek, and Jawbone Creek watershed projects.

Several nonstructural approaches to flood control have been initiated in recent years. One of these is flood plain regulation which limits development on the flood plain. There is a resistance to this type of regulation which is viewed as an infringement of property rights. However when damages do occur, assistance is requested by flood plain residents without concern over the property rights issue.

The responsibility for implementation of flood plain regulation has been given to the State of Montana and local communities. If

the local body does not adopt such regulations, the Department of Natural Resources and Conservation may impose and implement regulations.

Flood plain regulation can not reduce the damages to property already in the flood plain. For this reason, flood insurance has been provided by the federal government to help reduce the monetary damages suffered by those in the flood plain. To participate in the program, communities must adopt minimum requirements to reduce future flood damages.

The Flood Disaster Protection Act of 1973 expanded the flood insurance program and imposed restrictions on future federally-assisted funding for development in the flood plain, along with mortgage and disaster loans.

Future

In assessing the flood control needs for the FWO, an assumption was made that regulatory measures will be accelerated to impede future development in the flood plain. This is supported by past legislation and regulations and by Executive Order 11988, which restricts federal activities in the flood plain. The effects of this accelerated regulation are expected to reduce projected flood damages about 11 percent in 1990 and 16 percent in year 2000 from those damages which would have been experienced without regulation.

Current and projected flood damages are shown by planning area in table 18.

Remaining Needs

Table 18 shows the highest damages have occurred, and are expected to continue, in the Missouri-Marias planning area. Both rural and urban damages have been the greatest in this planning area. The Milk planning area has experienced the second highest amount of flood damges in the rural sector.

Streambank erosion along the Lower Judith River.

Streambank Erosion

Present

Streambank erosion is a serious problem throughout the study area, with the Missouri River below Fort Peck and the lower Judith River being two of the most critical areas. Conventional control works on a broad scale cannot be justified economically since rock

Table 18
CURRENT AND PROJECTED FLOOD DAMAGES

Planning Area	Area Subject To Flooding (1,000 Ac)	1975 Rural Damages ($1,000)	1975 Urban Damages ($1,000)	Total 1975 ($1,000)	Total 1990 ($1,000)	Total 2000 ($1,000)
Upper Missouri Tributaries	65.8	705	20	725	762	786
Missouri-Marias	278.8	3,222	1,382	4,604	5,085	5,398
Missouri-Musselshell	236.5	471	92	563	612	661
Milk	212.9	1,727	7	1,734	1,794	1,855
Missouri-Poplar	207.9	234	0	234	247	263
Upper Missouri Study Area	1,001.9	6,359	1,501	7,860	8,500	8,963

SOURCE: Flood Control and Erosion Technical Paper

Table 19
SUMMARY OF CURRENT AND PROJECTED STREAMBANK EROSION BY PLANNING AREA

Planning Area	Total Length of Channel	Current Erosion		Average Annual Damages		
		Total	Serious	1975	1990	2000
	(Stream Miles)	(Bank Miles)		($1,000)		
Upper Missouri Tribs.						
Tributaries	17,052	245	46	4	4	4
Main Stems	192	21	4	21	27	30
Missouri-Marias						
Tributaries	25,435	484	118	12	12	12
Main Stems	734	221	30	99	129	140
Missouri-Musselshell						
Tributaries	29,890	275	53	7	7	7
Main Stems	911	401	52	159	204	225
Milk						
Tributaries	20,225	169	23	4	4	4
Main Stems	1,521	224	23	81	104	114
Missouri-Poplar						
Tributaries	13,082	121	12	3	3	3
Main Stems	611	229	35	104	135	148
Upper Missouri Study Area	109,653	2,390	396	494	629	687
Tributaries	105,684	1,294	252	30	30	30
Main Stems	3,969	1,096	144	464	599	657

bank protection costs $200,000 to $500,000 per mile. The streambank erosion damage estimates are shown in table 19.

Future

Streambank erosion damages are expected to continue and to increase on the mainstems of the streams in the study area (table 19). The Corps of Engineers has been directed to establish and conduct a national streambank erosion control demonstration program. The sites selected for demonstration projects do not include any in the Upper Missouri study area. However, additional sites will be selected as time and funding permit.

Remaining Needs

The streambank erosion control needs are expected to be those shown in table 19, with the major need being control on the mainstems of the streams. Localized measures may be installed at various locations across the study area but their total impact is expected to be minimal.

Erosion control project in place on Spring Creek near Lewistown.

Land and Water Conservation

Conservation entails adequate protection of the soil and plant population from the destructive natural forces of water, wind, fire, and climate as well as the actions of man. Conservation also includes measures to enhance production. The objective of installing land conservation measures is to ensure continuous wise use of soil, water, and plant resources within their capabilities in order to maintain food and fiber production while maintaining and enhancing natural resource values.

Present

About 59 percent of the land in the Upper Missouri study area was considered to be adequately treated from a conservation standpoint in 1975. Land is considered to be adequately treated when the planned conservation practices and management systems necessary to prevent deterioration and maintain the productive capability of the resource have been applied.

Present trends indicate a wide divergence in accomplishment of land and water conservation practices among different land uses and for various planning areas. Some of the reasons for this include the limited source of capital available to the private landowner and inability of the operator to recover the costs or accrue the benefits of conservation measures. Such events as drought, fire, insects, and floods occur regardless of man's activities and reduce the opportunities for completely successful land conservation efforts. Table 20 shows the adequacy of conservation treatment for the major land uses in the study area along with the needs remaining for each category.

Table 20
STATUS OF LAND TREATMENT

Land Use and Ownership	Total (1,000 acres)	Adequately Treated—1975 (1,000 acres)	Remaining Needs (1,000 acres)
Irrigated Crop and Pasture	1,459	532	927
Dryland Crop	11,763	6,819	4,944
Range and Dry Pasture	28,075	14,897	13,178
(Nonfederal)	(21,716)	(11,995)	(9,721)
(Forest Service)	(1,455)	(1,328)	(127)
(BLM)	(4,904)	(1,574)	(3,330)
Commercial Forested	4,128	2,888	1,240
(Nonfederal)	(1,625)	(713)	(912)
(Forest Service)	(2,172)	(2,042)	(130)
(BLM)	(331)	(133)	(198)
Noncommercial Forested	3,183	3,007	176
(Nonfederal)	(380)	(373)	(7)
(Forest Service)	(2,532)	(2,497)	(35)
(BLM)	(271)	(137)	(134)
Other Lands	2,197	2,014	183
(State and Private)	(436)	(253)	(183)
(Other Federal)	(1,761)	(1,761)	(0)
TOTAL	50,805	30,157	20,648

SOURCE: Land and Water Conservation Measures Technical Paper

Some of the cropland treatment measures include conservation cropping systems, grassed waterways, strip cropping, stubble mulching, and diversions. Range and dry pastureland conservation treatment practices include proper range use, deferred grazing, fencing, livestock water development, brush management, and range or pasture seeding. Noncommercial forest land treatment is essentially the same as for range. In addition, commercial forest land treatment includes timber planting, selective harvest thinning, timber harvest, insect and fire control, and erosion control on critical areas.

Future

Current average annual rates of adequate land treatment were used as a straight line projection rate to project the FWO status of land treatment. The amount of land projected to be adequately treated by years 1990 and 2000 under the FWO is shown in table 21.

Remaining Needs

Land treatment needs by year 2000 will be significant for several categories. The greatest amounts of remaining needs are expected to occur in the categories of range and dry pasture, dry cropland, and irrigated crop and pasture.

Table 21
PROJECTED FWO LAND TREATMENT LEVELS AND ADDED COSTS[a]

Land Use and Ownership	Adequately Treated—1975	Treated—FWO 1990	Treated—FWO 2000
	(1,000 acres)	(1,000 acres)	
Irrigated Crop and Pasture	532	797	945
		(59,416)	(92,599)
Dryland Crop	6,819	8,382	9,531
		(12,332)	(21,398)
Range and Dry Pasture			
(Nonfederal)	11,995	13,649	15,028
		(40,573)	(74,399)
(Forest Service)	1,328	1,372	1,379
		(2,440)	(4,000)
(BLM)	1,574	3,748	4,370
		(33,175)	(42,667)
Commercial Forest			
(Nonfederal)	713	714	714
		(176)	(292)
(Forest Service)	2,042	2,132	2,133
		(116)	(236)
(BLM)	133	215	287
		(831)	(1,560)
Noncommercial Forest			
(Nonfederal)	373	373	373
		(60)	(120)
(Forest Service)	2,497	2,498	2,500
		(116)	(176)
(BLM)	137	212	248
		(898)	(1,330)
Other Lands	253	379	428
		(3,087)	(4,288)

[a]Additional total investment costs required to bring treatment from current level (1975) to level indicated are shown in thousands of dollars in parentheses.

SOURCE: Land and Water Conservation Technical Paper

Table 22
MUNICIPAL AND RURAL DOMESTIC WATER USE

Planning Area	1970 Municipal	1970 Rural Domestic	2000 Municipal	2000 Rural Domestic
	--(million gallons per day)--			
Upper Missouri Tribs	8 16[a]	1 63	11 42	2 75
Missouri-Marias	26 49	4 56	34 80	5 69
Missouri-Musselshell	3 29	1 10	3 40	1 14
Milk	6 05	1.53	6 71	1 73
Missouri-Poplar	2 94	0.96	3 23	0 85
TOTAL	46 93 (52,530 AF/yr)	9 78 (10,950 AF/yr)	59 14 (66,240 AF/yr)	12 16 (13,620 AF/yr)

[a]Does not include 8 97 mgd diverted to Butte outside the study area.

SOURCE Municipal, Industrial, and Rural Domestic Water Supply Technical Paper

Municipal, Industrial, and Rural Domestic Water Supplies

Over 90 percent of the study area communities use ground water for their water supply. However, domestic water supplies comprise only a small amount of total water use.

Municipal and Rural Domestic Supplies

Present

Present residential withdrawals in the study area are estimated at 56.7 million gallons per day (63,500 AF per year). Municipal systems serve about two-thirds of the population.

No complete estimates of current municipal and rural domestic water use are available. For purposes of this study, estimates of 100 and 236 gallons per person per day were used to estimate rural domestic and municipal use, respectively. The number of rural water users for each planning area was determined by subtracting city and town population estimates from total county populations. The estimated water use for 1970 and that projected for year 2000 are shown in table 22. The total daily use in 1970 was 56.7 million gallons.

Many communities and rural water users in the eastern portion of the study area rely upon ground water supplies and have water quantity and quality problems. Under provisions of the Safe Drinking Water Act (1974), all public water supplies are not to exceed specific concentrations of contaminants adversely affecting health. High total dissolved solids, salinity, and iron content render many of the residential supplies marginal for domestic use. Often, the major problem is locating potable water supplies.

Municipal water use.

Future

Of the 247 community water systems inventoried in the study area, only 26 are considered adequate. The remaining systems will need to consider construction of additional facilities or updating their present systems. More than half of the communities rely on individual wells and will continue to do so unless abnormal town growth occurs.

Ongoing community water needs in the form of updated water treatment and distribution systems, expanded storage facilities, and improved water sources are expected to be met under existing federal aid programs during the FWO.

Industrial Water Supplies

The industries considered in this section are "nonenergy" and include manufacturing , processing, mining, milling, and refining. Power generating uses are discussed under Energy Water in this chapter.

Water used by industries is either self-supplied, primarily from ground water, or from municipal supplies. The major industrial users are the mineral fuels and minerals industries. These include crude petroleum, natural gas, coal, copper, gold, and silver refining, as well as construction aggregate extraction.

Present

Forty-one industrial operations in the study area use water. The Anaconda steel processing plant in Great Falls uses the most, 1,380 gallons per minute per 24-hour day. The total industrial use is unknown but approximately 10,600 acre-feet were used in mineral fuels production and processing in 1977.

Future

No projections were made for industrial water requirements. A slight growth can likely be expected dependent upon economic and environmental analyses.

Sufficient water supplies are available for industrial water use in the FWO although isolated problems of quantity and quality may continue to occur.

Energy Water

Present

The present use of water for energy in the Upper Missouri study area is limited to hydroelectric plants. There are ten major generating plants located in the study area, none of which is thermal. Table 23 summarizes the annual generation and water volume for the ten hydroplants for the 1963-77 period. Because of their large surface area, evaporation losses have been estimated only for Fort Peck and Canyon Ferry Reservoirs. Average annual evaporation loss at Fort Peck, a multiple purpose reservoir, was 443,000 acre-feet for the 1963-77 period. Evaporation losses at Canyon Ferry averaged 76,400 acre-feet annually for 1966-77.

Only about eight percent of the total energy used in the state of Montana comes from hydrogeneration. The remainder comes from fossil fuels of coal, petroleum, and natural gas, with petroleum and natural gas supplying about 75 percent.

Table 23
SUMMARY OF WATER USE FOR EXISTING HYDROELECTRIC FACILITIES
1963-77 PERIOD

Facility	Drainage Area (square miles)	Annual Volume (acre-feet)	Average Annual Generation (megawatt hours)
Fort Peck	57.500	7,435,353	1,242,384
Morony	19,520	4,457,000	323,600
Ryan	19,510	3,791,000	458,700
Cochrane	19,500	4,567,000	321,200
Rainbow	19.495	3,494,000	274,800
Black Eagle	19,485	3,192,000	142,900
Holter	16,900	3,596,000	326,300
Hauser	16,625	2,734,000	125,700
Canyon Ferry	15,860	3,536,043[a]	437,410[a]
Madison	2,085	911,000	62,800
Total		37,803,396	3,715,794

[a]1966-77

SOURCE: The Montana Power Company, Corps of Engineers

Canyon Ferry Dam and Hydroplant on Missouri River near Helena.

Recent trends at hydropower sites have been to increase the peaking capability. Hydroplants have a much quicker response time and can meet the demand more readily than thermal plants. Converting base load hydroplants to peaking facilities reduces the requirement for constructing fossil-fueled plants—especially oil-fired turbines. In addition, hydro capacity for peaking enables a more economic loading of the fossil fuel plants to be achieved.

Future

Since there is no state or national policy on evergy development, projected demands for energy were not made. Pending development of a national energy policy, Montana has elected to "encourage economic opportunities, but not at the expense of a high quality environment."[4] Development of coal resources for energy and the transmission of that energy has been the subject of a long and heated debate among state interests. Montana has taken the position that each state must retain reasonable control over the development of its resources and that conservation and renewable energy alternatives must play a major role in future energy supply decisions.

Large, subsurface coal resources with potential for development exist both within and outside the Upper Missouri study area. However, water use would be small unless coal slurry methods are used — a practice currently illegal in the state of Montana.

Much of the future electrical energy generation is expected to come from coal. Coal supplied only 15 percent of the state's total energy consumption in 1976; however, over 90 percent of this coal was used to generate electricity.

Several additional demands for water in conjunction with energy development may occur in the FWO condition. These include: coal-fired plants of 1,400 megawatts (MW) capacity to be developed by The Montana Power Company (MPC); a coal conversion plant near Fort Peck; and a 1,200 MW thermal plant on the East Poplar River in Canada.[5]

The Montana Power Company expects load increases by year 2000 requiring 1,400 MW of new generation. If no hydrodevelopment occurs, MPC also anticipates a need for 300 MW of peaking capacity by 2000. The total consumptive use of these plants would be 16,100 acre-feet annually.

The Circle West proposal for development of a coal processing facility would involve the manufacture of ammonia, methanol, and synthetic diesel oil. The project would require about 67,000 acre-feet per year to be pumped from Fort Peck Reservoir. After passing through the plant, the remaining water would be used for irrigation.

The Saskatchewan Power Company is developing a 1,200 MW thermal plant including a reservoir on the East Poplar River and a lignite coal mine near Coronach, Saskatchewan, just north of the international boundary. The annual water requirements of this plant are estimated to total 7,800 acre-feet which will exceed the estimated firm draft of the reservoir. Air and water quality problems are anticipated from this plant and negotiations on minimizing them are continuing.

Fish and Wildlife

The Upper Missouri River Basin could well be unexcelled in the nation with respect to species abundance and diversity and supports a variety of wildlife and fish populations whose numbers and distributions have been altered or modified by farming and ranching, urban development, mining, and logging pursuits.

Present

The U.S. Fish and Wildlife Service administers a Wetland Acquisition Program.

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[4]Energy Water Use Technical Paper.

[5]From Energy Water Use Technical Paper

Wetland areas totaling 119,372 acres have been delineated for potential purchase through this program. To date, 18,700 acres have been acquired, of which 4,556 acres are actual wetlands. An additional 20,370 acres are protected through easements. These are semi-permanent and high quality waterfowl production areas. Table 24 lists the measurable amounts of wetland acreages by planning area. These wetlands include important migratory and resident waterfowl breeding habitat and are important hunting areas. The Water Bank Program in the study area maintains long-term agreements on 2,664 acres of wetlands and 11,446 acres of adjacent lands for wildlife production.

A very general, reconnaissance-level inventory of riparian habitat for the study area's major streams and rivers was completed for the purposes of indicating the magnitude of a potential preservation program. Table 25 depicts the number of streams and stream lengths in each planning area containing riparian habitat and their acreages. Though general, the survey does indicate the small amount of land area actually occupied by this unique habitat.

Swans and ducks on Freezeout Lake Game Management area near Fairfield.

Table 24
WETLANDS IDENTIFIED FOR POTENTIAL PURCHASE UNDER THE WETLANDS ACQUISITION PROGRAM

Planning Area	Number of Areas Delineated	Total Wetland & Adjacent Ac. Delineated	Acres of Protected Wetlands in Delineation
Upper Missouri Tribs.	4	2,286	387
Missouri-Marias	55	42,442	8,869
Missouri-Musselshell	5	2,840	782
Milk	30	27,809	6,076
Missouri-Poplar	84	43,995	10,934
Study Area	178	119,372	27,048

SOURCE: Fish and Wildlife Technical Paper

TABLE 25
RIPARIAN HABITAT ACREAGE BY PLANNING AREA

Planning Area	No. of Streams Surveyed	Stream Length Containing Riparian Vegetation (miles)	% of Total Stream Length	Approximate Riparian Acreage	% of Total Area
Upper Missouri Tribs.	14	111	19	28,800	0.34
Missouri-Marias	35	353	30	48,100	0.38
Missouri-Musselshell	13	360	53	37,000	0.25
Milk	9	183	39	23,700	0.23
Missouri-Poplar	2	187	97	32,300	0.49
Study Area	73	1,194	47.5	169,900	0.34

SOURCE: Fish and Wildlife Technical Paper

Setting aside required forage areas for wildlife is essential to their existence. In particular, winter range areas suitable for big game species have been identified. In some cases, these areas need protection to assure the survival of these big game species. A general estimate was made of the areas that should be maintained for existing uses to provide winter range. A total of approximately 390,000 acres are considered in need of some form of maintenance to preserve forage areas for wildlife.

Cold water game fishes are generally found in lakes and streams above Great Falls and are present in the isolated, eastern mountain ranges and in numerous farm ponds in the study area's lower portions These fish include six species of trout, Kokanee, arctic grayling, and mountain whitefish. Warm water game fishes are more abundant below Great Falls and include walleye, sauger, northern pike, bass, paddlefish, sturgeon, ling, and catfish.

The fishery above Great Falls, including the mountain front, is generally composed of cold, fast moving tributary streams. Most of these are relatively unpolluted and free-flowing. Approximately a dozen small- to medium-sized lakes and reservoirs supply lake fishing for trout, Kokanee salmon, perch and catfish.

The five or six major tributaries below Great Falls are generally slower moving. The Missouri River mainstem, Fort Peck Reservoir, and a few smaller reservoirs support the warm water fish species.

An important aspect of quantifying fish and wildlife requirements is the determination of minimum streamflow requirements for maintaining viable fish populations and their aquatic environment.

Future

Several major factors adversely affecting fish and wildlife populations are expected to continue. Major game animals and fish and their associated habitat and management problems are set forth in tables 26 and 27. Agricultural, hydropower, residential, and

Table 26
IDENTIFIED PROBLEMS ASSOCIATED WITH SELECTED SPECIES OF WILDLIFE

Type	Winter Range Problems	Conflicts With Other Game Animals	Subdivisions	Access to Public Land	Livestock Grazing	Sagebrush Control	Access to Private Lands	Lack of Population & Habitat Infor	Human & Wildlife Conflicts	Management Practices on Public Lands	Anti-Hunting (Trapping)	Water Level Manipulation
Mule Deer	X	X	X	X	X		X	X	X	X	X	X
Whitetailed Deer	X		X	X			X	X	X	X	X	X
Elk	X	X	X	X	X				X	X	X	
Antelope				X	X	X	X		X		X	
Moose								X			X	
Bighorn Sheep	X		X		X			X	X		X	X
Mountain Goat								X			X	

X–Indicates existing or potential problem area

SOURCE: Fish and Wildlife Technical Paper

Table 27
IDENTIFIED PROBLEMS ASSOCIATED WITH SELECTED SPECIES OF FISH

Type	Agricultural Activities	Logging	Subdivisions	Access to Private Lands	Disproportionate Fishing Pressure	Lack of Population & Habitat Infor.	Deterioration Stream Spawning Habitats	Excessive or Irregular Drawdown of Reservoirs	Low Flows (Agricultural)	Reservoir Development	Water Quality (Agricultural)
Trout in Streams	X	X	X	X	X	X			X		
Other Salmonoid Streams	X		X								
Nonsalmonoid Streams										X	X
Trout and Kokanee Lakes					X		X	X			
Other Salmonoid Lakes							X	X			
Nonsalmonoid Lakes								X			

X–Indicates existing or potential problem areas.

SOURCE: Fish and Wildlife Technical Paper

highway construction activities are expected to continue to cause loss of riparian habitat and their associated fish and wildlife resources. Agricultural, silvicultural, mining, municipal, and industrial wastes, and sediment from runoff and discharges are degrading water quality and limiting fishery resources. Stream dewatering by irrigation, particularly in late summer is reducing streamflows and adversely affecting aquatic habitat.

Northern pike being taken from Piskum Reservoir near Choteau.

The Department of Fish, Wildlife and Parks has purchased approximately 166,000 acres in the study area for habitat preservation. Acquisition is expected to continue under the FWO at the current rate of approximately 10,000 acres a year. The total acreage purchased by year 2000 would be about 416,000 acres.

Stockwater ponds provide an excellent source of wildlife cover and water. Wildlife enhancement structures near these ponds have improved wildlife accessibility in the past and are expected to continue under the FWO. Over 2,100 ponds are expected to be constructed by year 2000. About 10 percent of these ponds will be enhanced with wildlife structures.

Threatened or endangered species recovery plans are being prepared by the Fish and Wildlife Service for the gray wolf, whooping crane, bald eagle, and grizzly bear. Recovery plans for the black-footed ferret and peregrine falcon have been approved.

Remaining Needs

A basic need is to quantify wildlife requirements and to carry out a detailed inventory of riparian habitat acreage. Future programs and methods to preserve wildlife range habitat must also be identified and implemented where appropriate.

Efforts must be continued to develop a reliable and acceptable process for determining instream flow requirements. Viable means of maintaining instream flows for environmental purposes must also be developed. In addition, a reliable method for determining what species are politically and socially desirable is also needed.

Outdoor Recreation

Present

The Upper Missouri River Basin abounds with opportunities for outdoor recreation. From the mountainous expanse of Yellowstone and Glacier National Parks to the broad surface of Fort Peck Reservoir, a variety of recreational activities are available to both residents and nonresidents of the study area. These range from camping, fishing, hunting, and canoeing to cross-country skiing and snowmobiling.

The activity showing the highest annual participation is fishing, followed closely by hunting. Over one million fisherman days are currently spent in the study area. This is projected to increase to 1.7 million by 2000. Some of the major recreational activities and their current and projected use are shown in table 28. The projections are based on the

Cross-country skiing is a popular winter activity.

Table 28
CURRENT AND PROJECTED RECREATIONAL ACTIVITIES[a]

Activity	Current Participation	Projected Participation	
		1990	2000
Developed Camping	274,745	304,141	325,728
Undeveloped Camping	279,316	309,201	331,148
Picnicking	267,575	296,204	317,228
Boating	348,042	385,281	412,626
Backpacking	88,332	97,783	104,724
Skiing — Downhill	156,550	173,300	185,600
Cross-Country	104,356	115,521	173,721
Snowmobiling	169,606	187,753	201,079
Hunting	1,139,082	1,310,000	1,424,000
Fishing	1,370,600	1,577,000	1,714,000
Wildlife Observation	472,374	522,915	560,029
Bicycling	88,764	98,261	105,235
Motorcycling	156,487	173,231	185,526
Nonurban Swimming	219,327	242,793	260,026

[a]Expressed in number of occasions.

SOURCE: Outdoor Recreation Technical Paper

A portion of the wild and scenic reach of the Missouri.

current participation rate and the projected population. No variation from present use rates was assumed.

Recreation interests are not unanimous in their assessment of demands and adequacy of the resource to supply the demand. Some are willing to accept a greater density of use than others. Others feel moving the demand to available underutilized resource sites is preferable to additional development at the current resource site.

One of the more important recreational activities in the study area is river floating. The number of canoeing, kayaking, and rafting enthusiasts is growing each year, partly because of the economy of this pursuit and lack of need for formal launching facilities. These recreationists often prefer relatively undeveloped rivers, free of impoundments and with limited access. The Wild and Scenic Rivers program provides a framework for identifying, studying, and setting aside relatively unspoiled rivers and their adjacent land areas for this and other nonconsumptive uses.

The Missouri River, from Fort Benton to Ryan Island, was recently designated a National Wild and Scenic River stretch. This designation highlighted its recreational use and presently attracts large numbers of river floaters. Several other rivers, most of them in the Upper Missouri Tributaries planning area, have the potential for inclusion in a protected river system.

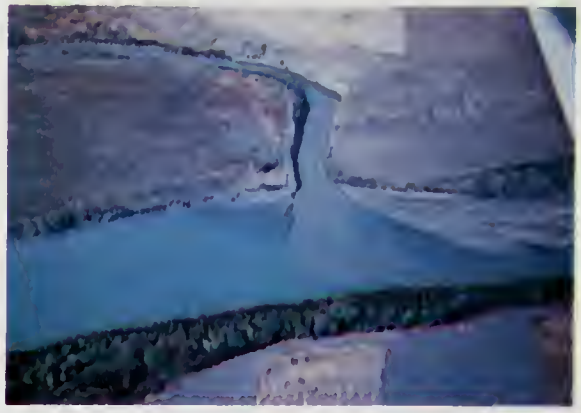
Future

With the exception of hunting (and stream fishing in some localized areas), all projected demands were assumed to be met in the FWO condition through continuation of existing programs.

Some problems will continue to exist even if all FWO conditions are met. Major remaining problems are the overuse of certain recreation areas, underuse of other recreation areas, and a lack of recreation opportunities during the winter months. Access to areas and sites will continue to be a problem and the hunter-landowner relationship problem will need concentrated effort if future hunting demands are to be satisfactorily met.

Water Quality

Water quality may be described by several parameters, including physical, chemical, and biological characteristics. Some degradation of quality is due to natural causes, such as seepage from mineral fields or erosion. Man's activities also cause water quality degradation. Most of the sources of pollution are municipal wastewater treatment facilities, industrial waste discharges, agricultural activities, and poor land use practices.



Muddy Creek discharging heavy sediment load into Sun River.

Present

Quality of both surface and ground water is generally excellent in the upper reaches of the Upper Missouri Tributaries, Missouri-Marias, Milk and Missouri-Musselshell planning areas. Water quality typically degrades in a downstream direction as the streams become more saline, carry higher nutrient loads, and have higher temperatures.

Water in many of the tributaries of the Missouri-Poplar planning area is poor in quality, being high in sodium, calcium and sulfate. Much of it is unsuitable for irrigation.

Table 29
CURRENT POINT SOURCE WATER QUALITY PROBLEM AREAS

Stream	Miles Affected	Problems
Beaverhead River below Dillon	3	Coliforms from Dillon sewage treatment plant
East Gallatin River below Bozeman	15	Ammonia from Bozeman sewage treatment plant
Spring Coulee	7	Phenols from Westco Refinery
Midvale Creek below East Glacier	9	Coliforms from East Glacier sewage treatment plant
Little Dry Coulee north of Conrad	4	Ammonia from Conrad sewage treatment plant
Big Spring Creek below Lewistown	10	Inadequate treatment by Lewistown sewage treatment plant

SOURCE: Water Quality Technical Paper

Point source discharges in the study area currently receive secondary treatment or its equivalent, or are on compliance schedules to provide such treatment as soon as practical. Table 29 identifies current point source pollution problem areas.

Most nonpoint pollution sources are related to land use. Irrigation water use and return flow, overgrazing, fallow crop areas, logging, residential land clearing, and stream vegetation removal account for over 90 percent of the study area's water quality problems.

Irrigation is the major user of water and the type of irrigation has a significant impact on the water quality change. Much of the irrigation is achieved by flooding and at least half of this water returns to the stream to be reused on its way downstream. Each use tends to increase the concentration of certain nutrients which may be in the soil as the water passes over or through it.

One of the major water quality problems in the state occurs on Muddy Creek, northwest of Great Falls, where excessive erosion and sedimentation degrade water quality. The problem results from a combination of naturally highly erosive soils and excessive return flows from a surface irrigation project. The resulting erosion has deposited sediment in the Sun River and Missouri River channels.

An innovative approach at controlling sediment has been initiated in Lewis and Clark County by the conservation district. A local ordinance restricts the activities which contribute sediment to receiving streams. Once a sediment source has been identified, the conservation district works with area residents to solve the problem. This approach appears to have potential use in many other sections of the study area.

Some degradation of ground water quality has occurred on the Highwood Bench in the Missouri-Marias planning area and near Roundup and Ryegate in the Missouri-Musselshell, where saline seep problems have recently appeared. The Triangle Conservation District has recently been established to assist in alleviating saline seep problems within the ten-county Triangle Area. Acid mine drainage is also a problem in the Missouri-Marias planning area, being present from metal mines in Carpenter, Galena, Lump Gulch and Spring Creeks, and from coal mines near Belt and in Sand Coulee Creek.

Table 30
STREAM MILES AFFECTED BY NONPOINT SOURCE POLLUTION

Cause of Pollution	Upper Missouri Tributaries	Missouri-Marias	Missouri-Musselshell	Milk	Missouri-Poplar
Sediments caused by agricultural, land use, and logging practices	317	294		112	
			300		
Dewatering & elevated temperatures caused by agricultural activity and sediments aggravated by poor land use practices.	208	251			
Toxic metals due to past mining activities	19	41			
Natural salts and sediments aggravated by poor land use practices	15	9 miles + 2 lakes	189	150	250
Coliforms from non-point sources and sewage treatment plants	23	14	21		
Eutrophication caused by poor land use practices			48		
TOTAL MILES	582	609	558	262	250

SOURCE: Water Quality Technical Paper

Several stream segments do not meet the objective of the Clean Water Act of 1977 (P.L. 95-217). Reasons for noncompliance range from excessive metal concentrations and high temperatures to unacceptable coliform and sediment levels. Table 30 lists the number of stream miles in each planning area affected by different natural and manmade activities.

Future

Several programs are designed to minimize point and nonpoint stream pollution within the planning period. Even after existing programs are implemented, particularly the 208 Water Quality Program, non-point source pollution will continue in some stream reaches.

All municipal and industrial waste contributions are assumed to be maintained at a tolerable level under the FWO. Current funding programs are estimated to continue in the future to provide for construction of treatment plants, as needed, and research on improved methods for pollution reduction.

An estimate was made of future Total Dissolved Solids (TDS) stream loading from irrigation development. The estimated acreages and resultant TDS are shown in table 31. The magnitude of the numbers is not of major importance but the changes should be noted for their significance and potential impact on existing water quality.

Table 31
ESTIMATED CHANGES IN TOTAL DISSOLVED SOLIDS FROM POTENTIAL IRRIGATION DEVELOPMENT

Planning Area or Subarea	Current Development[a]	FWO (2000) Development[a]	Current TDS[b]	FWO TDS[b]
	(1,000 ac)	(1,000 ac)	(mg/1)	(mg/1)
Upper Missouri Tributaries	583	542	210	200
Missouri-Sun-Smith	248	283	255	255
Marias	228	261	425	470
Musselshell	98	144	1,415	2,425
Middle Missouri	42	61	385	400
Milk	209	237	625	710
Missouri-Poplar	51	63	435	455
STUDY AREA	1,459	1,591		

[a] Irrigation development from Agricultural Water Technical Paper.
[b] TDS from Water Quality Technical Paper

CHAPTER IV

PLAN FORMULATION

Purpose

The Water Resources Council's **Principles and Standards** call for multi-objective planning which addresses the need for national economic development (NED) and environmental quality (EQ) plans. This chapter describes the plans formulated to meet these two objectives. Many of the basic guidelines used in the plan formulation process are outlined briefly in chapter 1.

Plan Formulation Process

The plan formulation process included an identification of problems and opportunities, an estimate of future without a plan (FWO) conditions, identification of remaining needs, identification of alternative solutions (plan elements) and the combining of these plan elements into alternative plans.

The capability of the FWO to meet the identified problems, needs, and opportunities was analyzed. Those needs and opportunities remaining beyond the FWO conditions were addressed by the National Economic Development and Environmental Quality Plans developed as alternative plans.

Public input into the planning process was accomplished in several ways. Assistance in identifying problems, solutions, and opportunities was provided early in the study through a series of public meetings. The technical papers developed by the various ad hoc groups were distributed to members of the citizen advisory committees. The initial NED and EQ plans were reviewed and discussed with the advisory committees and the preliminary recommended plan was reviewed with the public at a later series of meetings. In addition, many suggestions and comments were provided by the public through responses to questionnaires. These were utilized by study participants as the study progressed.

Analysis by Planning Area

The plan was initially developed by addressing individual planning areas. The upstream area, Upper Missouri Tributaries, was analyzed first and planning proceeded in a downstream order. This approach allowed the effects of elements proposed in the upper portions of the study area to be considered as their potential impact was passed downstream. While many plan elements were unique to a particular planning area,

some of the plan elements proposed were identical in several planning areas, differing only in magnitude.

Alternative Plans

The **Principles and Standards** call for the development of one or more alternative plans to meet the NED and EQ objectives. The purpose of this multiple alternative plan concept is to establish varying levels of attainment of the objectives so the impacts of each can be observed. In this study, only one alternative plan was developed for each of the objectives. Comparison of these two plans allowed "trade-offs" to be made in evolving the final recommended plan.

Several changes in plan elements occurred during the course of the study. These changes included modifications of the description, goals, and methods of implementation. Several plan elements were eventually compared and combined as part of an alternative plan.

Trade-offs between elements of the alternative plans were somewhat limited because of a lack of comparable NED and EQ information. This lack or variation in detail made it necessary for the plan formulation to primarily address qualitative issues.

Four-Account System

The **Principles and Standards** require the evaluation of effects or impacts for each plan element considered. This evaluation addresses the four factors of national economic development, environmental quality, regional development, and social well-being. These factors and their display are commonly referred to as a four-account system.

The purpose of the system is to provide a means for comparing various plan elements and their provisions and adequacy in meeting the NED and EQ planning objectives. This provides a basis for achieving later trade-offs between various elements as the recommended plan is evolved.

National Economic Development Account

This account shows the monetary costs and benefits of each plan element. The total cost of development and the amortized annual cost are shown along with the annual benefits that are measurable in dollars. The account portrays the impacts the proposed element would have on national economic efficiency. Benefits include those values which result in net income increases to the users as a result of such project purposes as irrigation, flood damage reduction, outdoor recreation, electric power, municipal and industrial water, and fish and wildlife. Benefits shown do not include indirect or second-level effects generated by business as a result of the project.

Environmental Quality Account

The Environmental Quality (EQ) account describes the effects each plan element has on the environment. These effects may be either beneficial or adverse and cover all facets of the environment.

Beneficial effects include those actions which result in enhancement or preservation of environmental characteristics of an area. Adverse effects are those impacts resulting in degradation of existing environmental attributes.

Unlike the NED account, most effects displayed in this account occur in terms of physical descriptions or general descriptive statements of changes in environmental characteristics. However, monetary values are shown to the extent evaluated and available.

Regional Development Account

This account is commonly referred to as the RD account and includes costs and benefits which occur within the study area. The account shows the direct benefits and the secondary (or indirect) benefits induced by the flow of products from the plan elements as well as secondary benefits that occur during any necessary construction. The secondary benefits are assumed to represent transfers from the rest of the nation; consequently, those strictly regional benefits do not appear as part of the national benefits.

The construction and operation costs, included in the national account and assumed to be borne by those living in the planning region, have been adjusted to reflect current laws governing repayment for various functional purposes. Some of the plan elements also show adverse effects in this account that result from the losses of local tax base and payments and possible changes in land use that may reduce economic activities.

Social Well-being Account

This account displays the impacts various plan elements have on social objectives or values. The changes in various social organizations or structures are defined and displayed. The expected overall gains or losses from a local populace standpoint can then be observed.

Some of the impacts which are exhibited in this account include the requirements for long- or short-term housing and school facilities. Both long- and short-term employment may be realized from proposed projects.

National Economic Development Plan

The objective of the National Economic Development (NED) Plan is to enhance national economic development by increasing the output of the nation's goods and services and to improve the national economic efficiency. The NED plan emphasizes the net benefits resulting from each of the actions proposed. For this study only one NED alternative plan was developed and the objective was to formulate a plan which produced the highest net economic benefits.

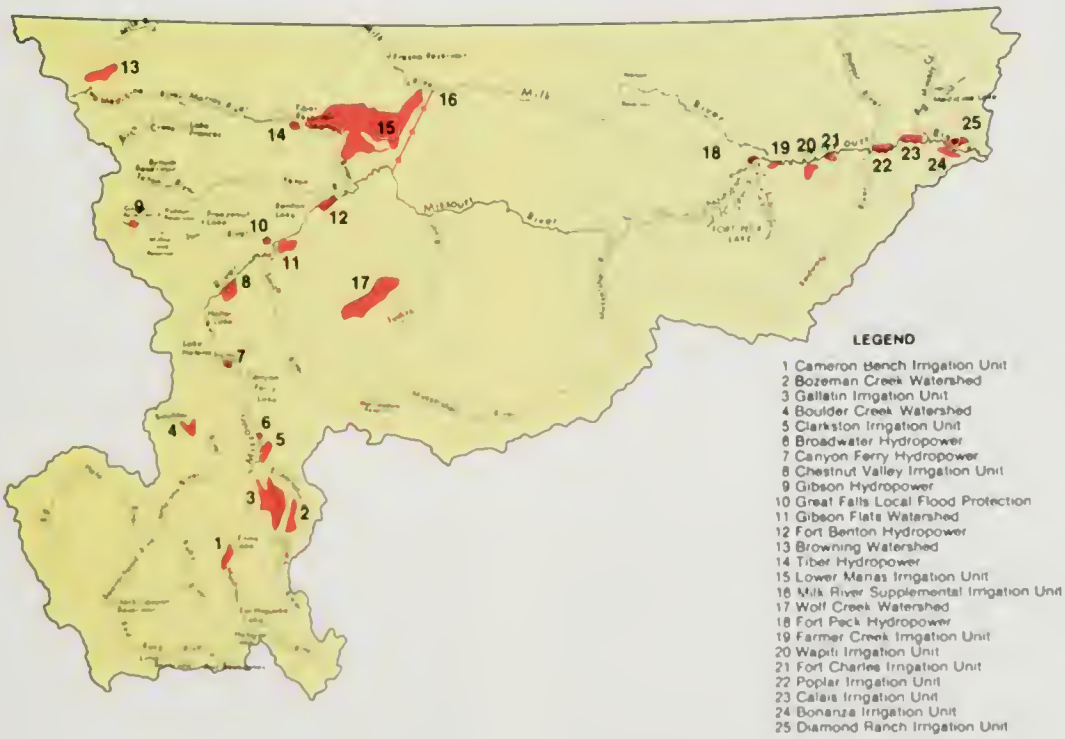
The NED Plan developed for the Upper Missouri study area is summarized by functional category in the following sections. Tables showing the four accounts for each plan element follow the narrative. Figure 11 shows the location of the NED plan elements.

Agriculture

Irrigation

Several potential projects have been analyzed which appear to have current feasibility for construction. Several of the projects may require changes in scope or features under future planning efforts. This section discusses some of the larger projects pro-

Figure 11
NED PLAN



posed and those projects having somewhat complex layouts or controversial features.

Cameron Bench Unit—Upper Missouri Tributaries Planning Area

Proposed development is on a bench along the Madison River and would require a diversion dam across the Madison. Because of the extensive use of the Madison for recreation and fishery values, any structure across the river is opposed by environmental interests.

Gallatin Unit—Upper Missouri Tributaries Planning Area

This unit is proposed for development from ground water and would utilize existing conveyance systems. Many of the lands are presently irrigated but need supplemental water. Determining the effects of ground water pumping on streamflow will be a principal part of the feasibility study of this project.

Several previous proposals have been made to develop the water and land resources in this vicinity. Alternative plans have analyzed reservoir sites on the Gallatin River and its tributaries, including construction of Spanish Creek Reservoir on the Gallatin River as the principal water supply feature. These alternatives were all subsequently dropped either because of environmental consequences or negative economic results.

Lower Marias Unit—Missouri-Marias and Milk Planning Areas

This unit would supply those lands originally planned for irrigation service from Lake Elwell at the time of construction of Tiber Dam. Development of the unit hinges on whether the original 160-acre limitation of the Reclamation Act is modified and acceptable to the potential users. The lands identified for irrigation lie mostly in the Milk River drainage and considerable return flows would accrue to Big Sandy Creek, a tributary of the Milk.

Elwell Reservoir is presently used for flood control with releases primarily for fish flows. If the project is developed and operated as originally proposed, a change in reservoir operation would be required.

Milk River Supplemental—Milk Planning Area

Streamflow in the Milk River is often inadequate to fully supply the acres developed for irrigation and future development of treaty allotted Milk flows by Canada will further decrease the amount of water available. Four alternatives for providing supplemental water to existing irrigated areas in the Milk River valley were investigated during the study.

The alternatives analyzed included a diversion from the Marias to the Milk, pumping plants at two locations on the Missouri River lifting water into the Milk River drainage and a pump and gravity system diverting from an arm of Fort Peck Reservoir. Each analysis considered both water for full service and supplemental irrigation, and supplemental irrigation only.

Alternative 2, a pump lift from the Missouri River near Virgelle into a 42-mile canal terminating in a regulating reservoir near Havre, yielded the highest net benefits and is included in the NED Plan. Supplemental service would be provided to 108,140 acres of presently irrigated lands in the Milk River Valley.

Water Conservation Measures—All Planning Areas Except Missouri-Poplar

This plan element entails the implementation of various conservation measures for both on- and off-farm irrigation practices. This program will require a high level of funding and technical assistance by the Soil Conservation Service and Water and Power Resources Service. The NED Plan proposes that 50 percent of the total measures identified be implemented by 2000. Measures analyzed for the Missouri-Poplar planning area were found to be economically infeasible.

Other Irrigation Elements

The remaining irrigation plan elements are mostly conventional pumping plant-gravity canal systems along the lower reach of the Missouri River. One small watershed project, Boulder River, would provide water for irrigation of 3,400 acres of new lands and 7,300 acres needing supplemental water along the Boulder River. All the irrigation elements are described on the tables following.

Canal on East Bench being prepared for membrane lining

Flood Control

The residual flood damages shown in table 18 provided an opportunity for analysis of viable solutions to be undertaken. Although flood damages are expected to be extensive in rural areas, the total magnitude of agricultural type losses does not often exceed the costs of providing protection. Thus, few solutions were found meeting the NED criteria requiring benefits to exceed costs.

Nonstructural Measures

Some actions or programs can be undertaken which will reduce flood damages or alleviate their impact without the use of structural measures. Included in this category are flood plain regulation, flood plain insurance, and floodproofing.

For this study, an assumption was made that flood plain regulation would continue and be accelerated in the FWO situation. This would effectively reduce the rate of increase in future flood damages but will require concerted effort by state and local authorities if it is to be accomplished.

Structural Measures

Structural measures were analyzed for several planning areas in an effort to provide solutions to the flood damages identified. There was considerable local interest in identifying structural measures to alleviate flood damages in the Judith and Sun River drainage areas. No storage reservoirs were found to be economically justified but some degree of flood reduction would be provided these areas by several measures suggested in the plan.

Great Falls Local Flood Protection Project

This project is recommended for construction funding. It has gone through the feasibility analysis and local commitments of land rights and provision for operation and maintenance are being obtained. Although this project provides only partial protection to the damage area, it was the only alternative identified and analyzed which demonstrated economic efficiency.

This project has generated local controversy for several years and the inclusion of it in the NED Plan did not end the controversy. Opponents accused study participants of not weighing public support and comments and of biased analyses. The fact that none of the other suggested alternatives for flood storage met the planning criteria did not dissuade project opponents from advocating such measures. The fact that the proposed project provides only partial flood protection also diminished its popularity. However, the project appears to have the support of a majority of the affected public who are continuing to pursue its implementation.

Levee along Sun River near Vaughn providing protection from 1975 flood.

Small Watershed Projects

Several small watershed projects having flood prevention as one of their purposes have been analyzed and included in the NED Plan. Most of these will require a feasibility study before implementation is considered. However, a feasibility study has been completed on the Browning project and it is recommended for construction. This project would protect the community of Browning on the Blackfeet Indian Reservation.

Hydropower

Several proposals were analyzed for hydropower. The primary emphasis was to consider peaking power. In some instances, recommendations are being made to change existing base load plants to peaking plants. In other cases, development of additional base load power is proposed. Again, these are proposals for additional studies which will analyze all impacts and determine the most desirable alternative for consideration for possible development.

One of the concerns expressed in regard to the larger hydropower installations is the effect peaking operations will have on the streamflow and channel regimen. Estimates of the changes in stage and impacts on the streamflow characteristics will be a part of the feasibility studies. Any mitigative measures required to replace fish and wildlife resources will be identified and included as part of the feasibility study in line with the Fish and Wildlife Coordination Act.

Three 16.67 MW generators in Canyon Ferry Power Plant.

Fort Benton Unit—Missouri-Marias Planning Area

Three alternatives have been analyzed in consideration of the plan element. The first two considered the construction of a high dam on the Missouri River a mile above Fort Benton with an afterbay dam about 11 miles downstream. One alternative included facilities for irrigation which the other did not. Subsequent to the development of these alternatives, the reach of the Missouri River where the afterbay dam would be located was designated as a wild and scenic river. This eliminated these alternatives from consideration.

The third alternative would consist of the same high dam on the river and a "run-of-the-river" power operation. This alternative had the greatest net benefits and is included in the NED Plan.

Canyon Ferry Unit—Missouri-Marias Planning Area

This proposal would change the existing power operation of Canyon Ferry from a base load plant to peaking power. To accomplish this, extensive modification of the dam including installation of a penstock for an additional powerplant would be required.

Concern has been expressed by some local citizens and governmental agencies that changes in operation will result in pool fluctuations below the reservoir which could adversely affect the fisheries and boating facilities. Adequate consideration of the potential impact will be included in the feasibility studies. An overall analysis of possible impacts of peaking operations downstream from Canyon Ferry should be made. Montana Power Company has expressed an interest in changing operation of its base load plants to peaking. The full impact of this potential change in operation of plants from Canyon Ferry to Morony Dam should be further analyzed by power development and environmental interests.

Fort Peck Unit—Missouri-Poplar Planning Area

This plan element proposed increasing the present generating capacity at Fort Peck Reservoir and changing the operation to peaking. A reregulation dam would be constructed about eight miles downstream from the existing reservoir. Although the reregulation dam would inundate some recreation facilities and fish and wildlife resources, it would reduce the present and projected river stage fluctuations. These fluctuations and their resultant erosion damages and soil losses were identified by the public as a critical problem. Mitigative measures for fish, wildlife, and recreation resource losses would be identified as part of this study phase.

Additional Hydropower Elements

Several smaller hydropower unit proposals have been included in the NED Plan. These are primarily for base load generation and are shown in the display tables following.

Table 32
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT: NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation)				
Upper Missouri Tribs. (1002) Cameron Bench Unit, Madison County Irrigable Area: New 17,300 acres Supplemental 3,400 acres Total 20,700 acres Supply Canal 32 miles (lined) Canal Capacity: Initial 475 cfs Terminal 105 cfs Laterals and drains—number unknown Located on a high bench east of the Madison River and extends from about nine miles south of Cameron to a point near the southeast shore of Ennis Lake. A concrete overflow weir diversion dam 25 miles downstream from Hebgen Lake—a gravel-covered crested weir would serve as a fish excluder. Below the excluder would be a radial gate—controlled headworks structure.	Direct Benefits (Annual) Irrigation $2,265,000 Adverse Effects (Annual Cost) Investment $1,489,000 O, M&R 159,000 Total $1,648,000 Net Beneficial Effects $617,000 Total Investment Cost $21,630,000	Vegetation along drains may provide cover and nesting sites for increased upland game bird populations. The diversion dam across the Madison River would block any recreational floating and movement of fish in this reach of the river. Return flows from irrigated lands may raise the temperature of the Madison River and Ennis Lake. Sediment load in the Madison may be increased as a result of return flows. A wasteway into Jack Creek may increase erosion. Some loss of natural vegetation utilized by wildlife would occur. Increased nutrients in Ennis Lake. Water withdrawal would degrade Madison River water quality.	Direct Benefits (Annual) Irrigation $2,265,000 Indirect Benefits (Annual) Irrigation $1,359,000 Employment $689,000 Total Annual Benefits $4,313,000 Adverse Effects (Annual) Investment $372,000 O, M&R 159,000 Total Annual Cost $531,000 Net Beneficial Effects $3,782,000	Construction period will last about 4 years. Construction man-years are estimated to be 275. During construction, population will increase by 280. Farm population would increase by 50. Construction population would require 90 housing units and facilities for 90 school children. O&M personnel estimated to total 5.
Gallatin Unit, Gallatin County Irrigable Acres: New 7,957 Supplemental 51,139 Total 59,096 One hundred ninety-three cased wells ranging in diameter from 16 to 24 inches would be drilled to depths of 30 to 120 feet. Deep-well turbine pumps, ranging from 1 to 4 cfs capacity, would be installed. The water would be distributed to the land in the existing system of private ditches which divert from the Gallatin and East Gallatin Rivers. A 12.47 KV distribution system, 81.8 miles in length, would be built to supply energy for each pump. This system will be served from two 2,000-kva stations to be constructed to receive power from The Montana Power Company system.	Direct Benefits (Annual) Irrigation $3,025,000 Adverse Effects (Annual Cost) Investment $ 975,000 O, M&R 204,000 Total $1,179,000 Net Beneficial Effects $1,846,000 Total Investment Cost $14,164,000	Distribution lines to serve 193 wells would be a visual intrusion. Due to the permeability of the soils, water used to irrigate the land would percolate to the aquifer carrying with it nutrients and salt. After reuse, the nutrient and salt concentrations may increase in the aquifer. Lowered aquifer level may result in percolation from the river to the aquifer and an attendant loss of flows in the Gallatin River.	Direct Benefits (Annual) Irrigation $3,025,000 Indirect Benefits (Annual) Irrigation $1,815,000 Employment $477,000 Total Annual Benefits $5,317,000 Adverse Effects (Annual) Investment $244,000 O, M&R 204,000 Total Annual Cost $448,000 Net Beneficial Effects $4,869,000	Construction period is less than 5 years. Total employment during construction is estimated to be 221 with a peak year construction employment of 112. Total population increase in the peak year is estimated as 170. Farmers would have a wider choice of crops to grow in addition to being less dependent on the weather for the success of those crops. Bozeman would absorb population influx of 170 people in the peak construction year. Some social service problems, such as housing, police, schools (approximately 53 students), etc., may develop with this temporary population. O&M personnel estimated to total 8.

Table 32 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation)				
Missouri-Marias (1003)				
Clarkston Unit, Gallatin County Irrigable Area: New 985 acres Clarkston Unit lies on a low bench on the east side of the Missouri River about six miles downstream from Trident. Clarkston Pumping Unit would be a small outdoor-type plant located on the east bank of the river, designed to pump 19 cfs from the river. A 4,160 volt distribution line would be constructed. Clarkston Canal, with a capacity of 19 cfs, would run north from the pumping plant about 8.5 miles to serve unit lands. Laterals and drains would also be built.	Direct Benefits (Annual) Irrigation $129,000 Adverse Effects (Annual Cost) Investment $76,000 O, M&R 12,000 Total $88,000 Net Beneficial Effects $41,000 Total Investment Cost $1,098,000	Upland game bird population may benefit from the additional food source. A power distribution line from Trident, Montana to the Clarkston Unit would be a visual intrusion. Native vegetation would be removed to construct a canal 8.5 miles long and laterals and drains. Airborne particulates would increase during the construction phase.	Direct Benefits (Annual) Irrigation $129,000 Indirect Benefits (Annual) Irrigation $78,000 Employment 35,000 Total Annual Benefits $242,000 Adverse Effects (Annual) Investment $19,000 O, M&R 12,000 Total Annual Cost $31,000 Net Beneficial Effects $211,000	Construction period will last less than 3 years. Total direct and indirect employment during construction is projected to be 18. The total population increase during construction is estimated to be 14. The project would establish 3 farms of 320-acre equivalency. No additional population increase would result. Three Forks is the largest town in the vicinity of the project. Because of the project's small size, adverse effects are expected to be minimal. O&M personnel estimated to total 1.
Chestnut Valley Unit, Cascade County Irrigable Area: New 4,470 acres Supplemental 1,890 acres Total 6,360 acres Located on the east bank of the Missouri River. It extends from the mouth of the Missouri River canyon downstream to about 7 miles northeast of the town of Cascade. An enlarged diversion works and headgate would be constructed. The main	Direct Benefits (Annual) Irrigation $783,000 Adverse Effects (Annual Cost) Investment $541,000 O, M&R 98,000 Total $639,000 Net Beneficial Effects $144,000 Total Investment Cost $7,856,000	Upland game bird populations may benefit from an increase in food sources. Trees would be removed along the river and along old stream meanders which run through the project area. Filling in of old stream meanders and removing trees would eliminate nesting and cover sites for some waterfowl, upland game birds, fur bearing animals and	Direct Benefits (Annual) Irrigation $783,000 Indirect Benefits (Annual) Irrigation $470,000 Employment 280,000 Total Annual Benefits $1,533,000 Adverse Effects (Annual) Investment $135,000 O, M&R 98,000 Total Annual Cost $233,000 Net Beneficial Effects $1,300,000	Construction period would last less than 5 years. Total employment during construction period is projected to be 141. The total population increase is estimated to be 105. Establish 20 farms of 320-acre equivalency. Assuming 30 percent of these farms (6) were purchased by nonlocal farmers the area population would increase by 20.

canal would be straightened and enlarged for about 10 miles and extended for another 11 miles. A small bench above the main canal would be served by a relift-pumping plant. A lateral system and subsurface drains would be constructed for the full-service land		some game animals. Sediment would increase during construction of diversion works. Irrigation return flows would increase sediment and nutrients There would be an increase in airborne particulate matter during construction.		The increased population from the project construction (105) would not have a significant effect on the community services of Great Falls However Cascade and Ulm may be adversely affected if a large portion of construction workers move into these towns O&M personnel are estimated to total 13
AGRICULTURE (Irrigation)				
Missouri-Marias (1003) & Milk (1005) Lower Marias Unit, Liberty, Chouteau and Hill Counties Irrigable Area: New (Marias River Drainage) 19,970 acres (Milk River Drainage) 107,030 acres Total 127,000 acres Water from Lake Elwell would be released to the Marias Canal through headworks adjacent to the left abutment of the dam. Marias Canal system would irrigate 76,600 acres of land by gravity and 33,400 by pumping. Construction of Lonesome Lake Dam and Reservoir, an off-stream reservoir on Twelve Mile Creek, for storage of return flows to be used for the irrigation of an additional 17,000 acres in Big Sandy Valley	Direct Benefits (Annual) Irrigation $15,240,000 Flood Control 616,000 Fish/Wildlife 201,000 M&I Water 58,000 Power 192,000 Total $16,307,000 Adverse Effects (Annual Cost) Investment $11,779,000 O, M&R 990,000 Total $12,769,000 Net Beneficial Effects $3,538,000 Total Investment Cost $171,110,000	Improved upland game bird resources in irrigated areas; improved waterfowl and fishing resources at Lonesome Lake. Increased populations of furbearing animals and upland game birds due to switch from dryland to irrigated farming; enlargement of Lonesome Lake would make it more productive. Return flows to Milk River would increase instream flows Conversion from dryland to irrigated farming practices would reduce wind erosion. Reduction of Marias River instream flows. Return flows would degrade quality of Marias and Milk Rivers.	Direct Benefits (Annual) Irrigation $15,240,000 Flood Control 616,000 Fish/Wildlife 201,000 M&I Water 58,000 Power 192,000 Total $16,307,000 Indirect Benefits (Annual) Irrigation $9,144,000 Employment 4,633,000 Total Annual Benefits $30,084,000 Adverse Effects (Annual) Investment $2,945,000 O, M&R 990,000 Total Annual Cost $3,935,000 Net Beneficial Effects $26,149,000	Project construction time is estimated to be 5 years The total man-years required for construction are estimated as 1,900 The total population increase during construction is estimated at 2,000 An additional 400 farms of 320 acres equivalent size would be created The on-farm population would increase by 600 people Havre is the largest community in the area A population influx of approximately 2,000 people during construction could put a strain on local community facilities and services such as schools The schools could receive as many as 700 students in the peak construction year The increased population would also require approximately 700 housing units, which could be met by trailers O&M personnel estimated to total 30

Table 32 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation)				
Milk (1005) Milk River, Supplemental Service, Virgelle-Havre, Alternative 2, Choteau-Hill Counties. Irrigable Area: Supplemental 108,140 acres The purpose of this plan is to provide supplemental water service to the Milk River Valley. A pumping plant located near the small community of Virgelle would lift water from the Missouri River to a 42-mile-long canal discharging into a regulating reservoir near the Milk River. Water would then be released down the river to supply supplemental water for existing irrigation development.	Direct Benefits (Annual) Irrigation $4,306,000 Adverse Effects (Annual) Investment $1,744,000 O, M&R 76,000 Total $1,820,000 Net Beneficial Effects $2,486,000 Total Investment Cost $25,338,000	Water quality in some sections of the Milk River may improve through the higher flows. The regulating reservoir would inundate rangeland. The reservoir would have extreme fluctuations. Exposed mud flats could be extensive because of regulating reservoir fluctuations. Exposed mud flats could be extensive because of regulating reservoir fluctuations. A powerline to serve the pumping plants would be a visual intrusion. Vegetation would be removed for the construction of the distribution system. Some riparian vegetation would be disturbed at creeks crossed by the canal. The canal may interfere with wildlife movement. Increased flows in the Milk River could increase bank erosion. Increases in sediment may affect the fisheries. At present the Milk River has a poor fishery due to water temperature, sediment and lack of suitable cover along its banks. Flows would be reduced in the Missouri River.	Direct Benefits (Annual) Irrigation $4,306,000 Indirect Benefits (Annual) Irrigation $2,584,000 Employment 805,000 Total Annual Benefits $7,695,000 Adverse Effects (Annual) Investment $436,000 O, M&R 76,000 Total Annual Cost $512,000 Net Beneficial Effects $7,183,000	Construction period will last 5 years. Total employment is projected to be 480 employees No new farms would be established. Havre is the largest community in the area. A population influx of approximately 360 people could put a strain on local community facilities and services, such as schools. There would be an increase in the student population of approximately 40 in the peak construction year. O&M personnel estimated to total 3.

		There would be an increase in airborne particulate matter during the construction of the canal and reregulating reservoir.		
Missouri-Poplar (1006) Bonanza Unit, Richland County. Irrigable Area: New 800 acres Located along the south bank of the Missouri River in Richland County about two miles south and somewhat east of the town of Culbertson. The pumping plant, located at the upstream (west) end of the irrigable area, would have a capacity of 15 cfs and lift water about 25 feet. A main supply lateral would follow along the toe of the slope of the valley bluffs on the south.	Direct Benefits (Annual) Irrigation $105,000 Adverse Effects (Annual Cost) Investment $57,000 O, M&R 9,000 Total $66,000 Net Beneficial Effects $39,000 Total Investment Cost $829,000	Irrigation may provide an additional source of food for migratory waterfowl. This unit would require removing dense cottonwood trees and brush located along the river. Nesting and cover sites would be reduced. Possible increase in sediment during the construction phase.	Direct Benefits (Annual) Irrigation $105,000 Indirect Benefits (Annual) Irrigation $63,000 Employment 28,000 Total Annual Benefits $196,000 Adverse Effects (Annual) Investment $14,000 O, M&R 9,000 Total Annual Cost $23,000 Net Beneficial Effects $173,000	Construction period will last less than 3 years. Total direct and indirect employment is projected to be 14. The total population increase during the project is projected to be 10. The project would establish 2.5 farms of 320-acre equivalency. No additional population increase would result as it is assumed that the local population would supply the farm families. Culbertson is the largest town in the vicinity of the project. Because of the project's small size, adverse effects are projected to be minimal.
Diamond Ranch Unit, Roosevelt County. Irrigable Area: New 900 acres The land lies along the left (north) bank of the Missouri River about 4 miles southeast of the town of Culbertson. The pumping plant, located at the upstream end of the irrigable area, would have a total capacity of 16 cfs and lift irrigation water about 40 feet into a 3-mile-long main supply canal extending along the toe of the slope on the north side of the unit area.	Direct Benefits (Annual) Irrigation $118,000 Adverse Effects (Annual Cost) Investment $68,000 O, M&R 10,000 Total $78,000 Net Beneficial Effects $40,000 Total Investment Cost $981,000	Irrigation may provide an additional food source for migratory waterfowl. Removal of trees would eliminate some of the nesting and cover sites. There may be an increase in sediment during the construction phase.	Direct Benefits (Annual) Irrigation $118,000 Indirect Benefits (Annual) Irrigation $71,000 Employment 32,000 Total Annual Benefits $221,000 Adverse Effects (Annual) Investment $17,000 O, M&R 10,000 Total Annual Cost $27,000 Net Beneficial Effects $194,000	Construction period will last less than 3 years. Total direct or indirect employment during construction is projected to be 17. The total population increase during construction is estimated to be 12. The project would establish 3 farms of 320-acre equivalency. No additional population increase would result as it is assumed the local population would supply the farm families. Culbertson is the largest town in the vicinity of the project. Because of the project's small size, adverse effects are expected to be minimal. O&M personnel estimated to total 1.

Table 32 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation) (1006 cont.)				
Fort Charles Unit, McCone County. Irrigable Area: New 3,187 acres This Unit is situated on the south side of the Missouri River across from the town of Wolf Point and is composed almost entirely of bottom land. A river pumping plant with 3 pumps would lift 60 cfs of water an average of 20 feet. A 43 cfs relift plant would lift water 10 feet to the east two-thirds of the unit. The Fort Charles Canal would extend 2.7 miles and serve 1,275 acres ahead of the relift plant and would continue 7.3 miles beyond. Laterals 14.7 miles Open Drains 5.7 miles Closed Drains 20 miles	Direct Benefits (Annual) Irrigation $418,000 Adverse Effects (Annual Cost) Investment $202,000 O, M&R 30,000 Total $232,000 Net Beneficial Effects $186,000 Total Investment Cost $2,937,000	A majority of the remaining trees would be removed when the land is developed for irrigation. Some nesting and cover sites may be eliminated when trees and brush are removed. Sediment and nutrient levels would increase from increases in irrigation return flows. Temporary increase in airborne particulates during construction phase.	Direct Benefits (Annual) Irrigation $418,000 Indirect Benefits (Annual) Irrigation $251,000 Employment 96,000 Total Annual Benefits $765,000 Adverse Effects (Annual) Investment $50,000 O, M&R 30,000 Total Annual Cost $80,000 Net Beneficial Effects $685,000	Construction period will last less than 3 years. Total direct and indirect employment during construction is projected to be 50. The total population increase during construction is estimated to be 37. The project would establish 10 farms of 320-acre equivalency. The permanent population of the area would increase by approximately 10. Wolf Point is located across the river from the project. The increased population (37) during project construction may have a slight adverse effect on the city's facilities, such as schools (11 additional school-age children), housing, utilities, etc. O&M personnel estimated to total 1. Creation of 3 new farm units.
Calais Unit, Roosevelt County Irrigable Area: New 6,410 acres The arable land is located on the terrace on the north side of the Missouri River in fairly contiguous blocks from 1½ miles east of Brockton to Big Muddy Creek. A pumping plant on the river would lift water an average of 18 feet and deliver it into a canal and lateral system. Canal 15.3 miles Maximum Capacity 115 cfs Laterals 30.2 miles Open Drains 1.0 miles Closed Drains 15.2 miles	Direct Benefits (Annual) Irrigation $789,000 Adverse Effects (Annual Cost) Investment $522,000 O, M&R $162,000 Total $684,000 Net Beneficial Effects $105,000 Total Investment Cost $7,586,000	Irrigation may provide an additional food source for migratory waterfowl. The removal of trees and brush would eliminate cover and nesting sites for game and nongame animals. There will be a small increase in sediment during the construction phase.	Direct Benefits (Annual) Irrigation $789,000 Indirect Benefits (Annual) Irrigation $473,000 Employment 309,000 Total Annual Benefits $1,571,000 Adverse Effects (Annual) Investment $130,000 O, M&R 162,000 Total Annual Cost $292,000 Net Beneficial Effects $1,279,000	Construction period will last less than 5 years. Total employment during construction is estimated to be 134. The total population increase is estimated to be 100 in the peak year. The project would establish 20 farms of 320-acre equivalency. Wolf Point is the largest town in the area. The increase in population during the peak year construction (100) could put a strain on city services and facilities such as schools (30 additional school children), housing and utilities. Other towns in the area

				such as Brockton, Calais and Poplar may also be adversely affected if a large percentage of construction people move into these areas O&M personnel estimated to total 5 Creation of 6 new farm units
Farmer Creek Unit, McCone County. Irrigable Area: New 888 acres This Unit is situated on the terrace south of the Missouri River about 15 miles downstream from Fort Peck Dam. The Unit would be served by five pumps which would be installed at 3 sites along the river. One pump would have a capacity of 4 cfs, the others would be 5 cfs, all pumping against a static head of about 20 feet. These semiportable pumps would be located close to the water surface and removed to higher ground in winter to be safe from high water and ice flow. Laterals 0.6 miles Subsurface Drains (closed) 3.0 miles	Direct Benefits (Annual) Irrigation $116,000 Adverse Effects (Annual Cost) Investment $38,000 O, M&R 8,000 Total $46,000 Net Beneficial Effects $70,000 Total Investment Cost $558,000	Irrigation may provide an additional food source for migratory waterfowl. Cottonwood trees and brush would be removed when the land is leveled for irrigation. Nesting and cover sites would be reduced when the trees and brush are removed.	Direct Benefits (Annual) Irrigation $116,000 Indirect BEnefits (Annual) Irrigation $70,000 Employment 21,000 Total Annual Benefits $207,000 Adverse Effects (Annual) Investment $9,000 O, M&R 8,000 Total Annual Cost $17,000 Net Beneficial Effects $190,000	Construction period will last less than 3 years Total direct and indirect employment is projected to be 11 The total population increase during construction is estimated to be 8 The project would establish 3 farms of 320-acre equivalency Therefore, no additional population increase would result as it is assumed the local population would supply the farm families Frazer is the largest town in the vicinity of the project Because of the project's small size adverse effects are projected to be minimal O&M personnel estimated to total 1
Poplar Unit, Roosevelt County. Irrigable Area: New 4,440 acres This unit consists of noncontiguous blocks of land on the terrace north of the Missouri River, extending from the vicinity of Poplar to the town of Brockton. This Unit consists of two areas— Poplar I and II. Pumping Plant (Located east of Poplar) Total Capacity: 77 cfs Poplar I—Poplar West Canal (2.3 miles) would serve 400 acres; capacity—20 cfs. —Poplar East Canal (9.1 miles) would serve 2,840 acres; capacity—57 cfs; laterals—10.2 miles. Poplar II—1,200 acres would be served by semiportable installations at 4 sites along the river, no canals, laterals—1 6 miles. Total Closed Drains 14 miles	Direct Benefits (Annual) Irrigation $577,000 Adverse Effects (Annual Cost) Investment $355,000 O, M&R 38,000 Total $393,000 Net Beneficial Effects $184,000 Total Investment Cost $5,162,000	Irrigation may provide an additional food source for migratory waterfowl. The irrigation of this unit will require removing some of the cottonwood trees and brush. Nesting and cover sites for game and nongame animals will be reduced through the removal of trees and brush. There may be a possible increase in sediment during the construction phase.	Direct Benefits (Annual) Irrigation $577,000 Indirect Benefits (Annual) Irrigation $346,000 Employment 168,000 Total Annual Benefits $1,091,000 Adverse Effects (Annual) Investment $89,000 O, M&R 38,000 Total Annual Cost $127,000 Net Beneficial Effects $964,000	Construction period will last less than 3 years. Total direct and indirect employment during construction is projected to be 92 The total population increase is estimated to be 70 The project would establish 14 farms of 320-acre equivalency The area population would increase by 14 Poplar and Brockton are the major towns in the project area The increased population during project construction may have a slight adverse affect on the cities' facilities such as schools (22 additional school-age children), housing, utilities, etc O&M personnel estimated to total 1

Table 32 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation) (1006 cont.)				
Wapiti Unit, McCone County Irrigable Area: New 3,739 acres This unit is situated on the south side of the Missouri River across from the town of Oswego and consists of two areas separated by Prairie Elk Creek. An 87 cfs pumping plant would be located on the river near the mouth of Elk Creek. Three pumps with a 30 foot lift would serve the west side of the creek, and 7 pumps with a lift of 73 feet would serve the east side. Electrical energy would be provided from the Water and Power Resources Service's Fort Peck-Williston transmission line on the north side of the river. The 3-mile-long Elk Prairie Canal would serve 690 acres west of the creek and the 10-mile-long Wapiti Canal would serve the east side. Laterals 12.2 miles (20 percent concrete lined) Open Drains 1.7 miles Closed Drains 16.8 miles	Direct Benefits (Annual) Irrigation $490,000 Adverse Effects (Annual Cost) Investment $285,000 O, M&R 35,000 Total $320,000 Net Beneficial Effects $170,000 Total Investment Cost $4,143,000	Irrigation may provide an additional food source for migratory waterfowl. Irrigation of this unit will require removing a large number of trees with a thick brush undercover. Removing trees and brush would eliminate nesting and cover sites for game and nongame animals. There will be an increase in sediment during the construction phase. Airborne particulate matter would increase during the construction phase.	Direct Benefits (Annual) Irrigation $490,000 Indirect Benefits (Annual) Irrigation $294,000 Employment 125,000 Total Annual Benefits $909,000 Adverse Effects (Annual) Investment $71,000 O, M&R 35,000 Total Annual Cost $106,000 Net Benefical Effects $803,000	Construction period will last less than 3 years. Total employment during construction is projected to be 66. The total peak year population increase is estimated to be 49. The project would establish 12 farms of 320-acre equivalency. Wolf Point is the largest town in the vicinity. The increased population (49) during project construction may have a slight adverse effect on the city's facilities such as schools (15 additional school-age children), housing, utilities, etc. O&M personnel estimated to total 1.
Study Area (except for area 1006)[a]				
Implement water conservation measures on existing irrigated lands—high level. Off-farm Systems Opportunities include: 1) Reservoir storage 2) Diversions, pumping and use of ground water 3) Canal consolidation 4) Supply management 5) Canal lining and piping	Direct Benefits (Annual) Irrigation $31,767,000 Adverse Effects (Annual Cost) $18,350,000 Net Beneficial Effects $13,417,000 Total Investment Cost $266,566,000	Reduced diversion. Improve or reclaim wet or seeped lands. Decreased return flows. Loss of wildlife habitat. Increased salt buildup on certain soils. Decreased salt pickup.	Direct Benefits (Annual) Irrigation $31,767,000 Indirect Benefits (Annual) Irrigation $19,134,000 Employment 746,000 Total Annual Benefits $51,771,000 Adverse Effects (Annual) $9,478,000 Net Beneficial Effects $42,293,000	Increase employment by an average annual equivalent of 360 man-years Direct employment 200. Population increase of 540. Indirect income to agricultural community $19,175,000. Increased water supply will result in greater stabilization of agricultural income.

6) Irrigation structures 7) Waterways 8) Main drains On-farm Opportunities include: 1) Pipelines and canal lining 2) Land Leveling 3) Land smoothing 4) Irrigation structures 5) Drainage improvements 6) Sprinkler irrigation 7) Automated surface irrigation 8) Irrigation water management				Possible adverse impact on families from significant amount of work taking place in any sparsely populated areas within a short time
[a]Missouri-Poplar Planning Area was eliminated because of an indication of infeasibility.				
FLOOD CONTROL				
Upper Missouri Tribs. (1002) Bozeman Creek Watershed, Gallatin County. Flood prevention along Bozeman Creek and the adjacent area, including the city of Bozeman. Improvements would include a bypass diversion.	Investment Cost $35,900 Annual Cost $2,700 Annual Benefits $11,800	No significant adverse impacts. Reduction in the amount of pollution and urban waste being flushed into the river system.	Not available.	Provide 4 man-years of temporary semi-skilled construction and service employment. Enhancement of quality of life, health and safety for 200 residents. Protects 80 acres of urban land. Provide 100-year level of protection to local businesses, homes, housing.
Missouri-Marias (1003) Browning Watershed, Glacier County Flood prevention for the city of Browning. One floodwater retarding structure on Willow Creek and two floodwater diversions are planned. Reservoir storage capacity of 847 AF.	Investment Cost $1,079,000 Annual Cost $84,300 Annual Benefits $105,000	Stream channel of 0.7 miles would be periodically inundated by the reservoir. Create 22 acres of waterfowl nesting area. Controlled flows will improve bank revegetation, reduce pollution from flood flows through town, encourage urban renewal and town beautification project. Sixty-eight acres for retarding pool.	Twenty acres of low production agricultural land lost from tax base.	Provide 100-year level of protection to 64 businesses, and 219 homes. Provide 31 man-years of temporary semi-skilled construction and service employment. Housing for 1,180 people in a 92-acre area in Browning.
Gibson Flats Watershed, Cascade County. Flood prevention dike, diversion and pumping plant.	Investment Cost $256,000 Annual Cost $19,510 Annual Benefits $20,000	No significant adverse impacts. Reduction of disease vectors.	Insignificant	Provide 100-year level of protection to Gibson Flats subdivision at south edge of Great Falls.

Table 32 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
FLOOD CONTROL				
Missouri-Marias (1003) Great Falls Local Flood Protection, Cascade County Sponsors—West Great Falls Flood Control District The project will be located on the left bank of the Sun River in west Great Falls. Left Bank Levee 31,800 feet in length, 15.5 feet high (adjacent to river). Drainage Structures 16 Installed Riprap 6,250 feet (200 tons) Two Borrow Sites 29 and 33 acres Project beautification. Runoff from Watson Coulee will be routed by a 3,200 foot collector ditch and a 2,300 foot interceptor levee and drain into two 84-inch conduits which will pass the water through the project area to Sun River.	Investment Cost $10,122,000 Annual Cost $704,300 Annual Benefits $1,199,000	Better drainage and mosquito control. Ecological effects will be insignificant. Terrestrial and aquatic environmental losses and degradation will be small. No wetlands, threatened or endangered species will be affected. Temporary adverse impacts on water and air quality due to construction.	User Benefits $1,999,000 211 acres of land will be committed to the project.	Provide flood protection up to level of the 500-year flood for 1,600 residents (469 families), 3 businesses, 1 church, and 1 grade school. Protect 1,092 acres from flooding and related health problems. Eight families would be displaced.
Missouri-Musselshell (1004) Wolf Creek Watershed, Fergus County Flood prevention for the town of Denton. Diking along Wolf Creek and an overflow, grassed waterway channel	Investment Cost $314,000 Annual Cost $22,400 Annual Benefits $41,000	No significant adverse environmental effects.	Not available.	Enhancement of quality of life, health and safety for 200 residents. Protects 80 acres of urban land. Provide 100-year level of protection to local businesses, homes, housing. Provide 4 man-years of temporary semi-skilled construction and service employment.
HYDROPOWER				
Missouri-Marias (1003) Fort Benton Unit, Alt #3, Chouteau County Powerplant Capacity 160 megawatts Located on the Missouri River about one mile upstream from Fort Benton. The dam would be a rolled earthfill structure 204 feet high and 4,550 feet long at the crest, containing 15,000,000 cubic yards of material The spillway, located in the right abutment, would be a gate-controlled, rectangular, concrete chute and have a maximum discharge of 245,000 cfs. Annual generation would	Direct Benefits (Annual) Power $31,057,000 Fish/Wildlife 354,000 Recreation 1,525,000 Total $32,936,000 Adverse Effects (Annual Cost) Investment $19,363,000 O, M&R 1,128,000 Total $20,491,000 Net Beneficial Effects $12,445,000 Total Investment Cost $281,282,000	Fort Benton Reservoir may create a more favorable habitat for non-game fish than does the river at present. Increased numbers of these fishes may move from the reservoir up Belt and Highwood Creeks and provide warm-water fishing. The reservoir would inundate a number of islands in the river, covered with willows, cottonwoods and marsh grass. The impoundment may cause the	Direct Benefits (Annual) Power $7,764,000 Fish/Wildlife 177,000 Recreation 763,000 Total $8,704,000 Indirect Benefits (Annual) Employment $8,504,000 Total Annual Benefits $17,208,000 Adverse Effects (Annual) Investment $4,841,000 O, M&R 282,000 Total Annual Cost $5,123,000	The project is estimated to take 4 years to complete. Total man-years required for project construction are estimated at 4,220. The peak year on-site employment is estimated at 2,110. The total population increase during the peak construction period is estimated as 4,335. Project operation and maintenance (O&M) personnel are estimated to total 14. The population would be increased by 21.

required The reservoir would extend some 30 miles upstream to the tailwater of existing Morony Dam and have a surface area of 10,200 acres and contain 880,000 acre feet This would be a run-of-the-river operation.		introduction of predator fish, such as northern pike, into Belt and Highwood Creeks The reservoir would inundate 30 miles of the Missouri River Canyon almost to the tailwaters of Morony Dam.	Net Beneficial Effects $12,085,000	Great Falls and Fort Benton are located in the project area. The overcrowding could adversely affect some segments of the population and tax the housing and school facilities Inundation of prime farm land
HYDROPOWER (1003 cont.)				
Gibson Power Plant, Teton and Lewis and Clark Counties Capacity 7.5 megawatts Located on the Sun River, approximately five miles downstream from the confluence of North Fork and South Fork of the Sun River. This powerplant would be just downstream from the face of the existing Gibson Dam and would utilize approximately 150 feet of head developed behind the dam. In addition to the powerplant and penstocks, a switchyard and transmission lines leading to the Rainbow Substation would be required. At the time of initial construction of Gibson Dam, a powerplant was contemplated and two 72-inch outlets through the dam were provided for future power development.	Direct Benefits (Annual) Power $1,473,000 Adverse Effects (Annual Cost) Investment $715,000 O, M&R 157,000 Total 872,000 Net Beneficial Effects $601,000 Total Investment Cost $10,387,000	The construction of a powerplant, penstocks, switchyard and transmission lines would detract from the natural beauty of the area. If the operation of Gibson does not change, the impacts would be minor. A temporary increase in sediment would occur, during the construction phase. Airborne particulates would temporarily increase during the construction phase.	Direct Benefits (Annual) Power $368,000 Indirect Benefits (Annual) Employment $404,000 Total Annual Benefits $772,000 Adverse Effects (Annual) Investment $179,000 O, M&R 39,000 Total Annual Cost $218,000 Net Beneficial Effects $554,000	Project construction is estimated to take 3 years to complete Total man-years during construction are estimated as 197 Total peak year employment is estimated as 95. The total peak year population increase is estimated as 140. Operation and maintenance of project facilities are estimated to require 5 employees. Choteau is the largest community in the area. A short-term population increase of 140 people could put a strain on the community facilities and services An estimated 40 housing units would be required most of which could be trailer houses School facilities would also be needed to handle approximately 20 additional students in the peak construction year.
Tiber Powerplant, Liberty County Capacity 5.0 megawatts This powerplant would be located adjacent to the existing Tiber Dam, which is located approximately 19 miles southwest of Chester, Montana on the Marias River. The proposed powerplant would be just downstream from the 72-inch outlet pipe and utilize the discharges for power generation In addition to the powerplant, a surge tower, new switchyard and some transmission lines in the vicinity of the powerplant would be required An existing Water and Power Resources Service's 115-KV line leading from Tiber Dam to a tap west of Chester could be utilized for transmission of power from the proposed powerplant	Direct Benefits (Annual) Power $1,143,000 Adverse Effects (Annual Cost) Investment $411,000 O, M&R 84,000 Total $495,000 Net Beneficial Effects $648,000 Total Investment Cost $5,967,000	Visual intrusion of power transmission lines. Vegetation along the transmission line would be disturbed and in specific instances may have to be removed, e.g. trees. Releases for power generation may affect goose nesting sites downstream. Fluctuations in the reservoir content may affect the fishery. Sediment would increase during the construction phase. Increases in airborne particulates would occur during the construction phase.	Direct Benefits (Annual) Power $286,000 Indirect Benefits (Annual) Employment $228,000 Total Annual Benefits $514,000 Adverse Effects (Annual) Investment $103,000 O, M&R 21,000 Total Annual Cost $124,000 Net Beneficial Effects $390,000	Project construction is estimated to take 3 years to complete Total man-years during construction is estimated as 115 Total peak year employment is estimated as 55. The total peak year population increase is estimated as 85. Operation and maintenance of project facilities is estimated to require 6 employees Chester is the largest community in the area A short-term population increase of approximately 80 people could put a strain on the community facilities and services

Table 32 (Continued)
DISPLAY AND BENEFICIAL AND ADVERSE EFFECTS
NED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
HYDROPOWER (1003 cont.)				
Broadwater Powerplant, Broadwater County Capacity 10 megawatts Located close to the headwaters of the Missouri River near Toston. The existing Broadwater Dam would be used for the development of low head generating capability.	Investment Cost $11,900,000 Annual Cost $1,070,000 Annual Benefits $1,473,000	Decreased flow fluctuations. Fewer mud flats.	Not available.	Provide employment for small operation and maintenance force.
Canyon Ferry Powerplant, Lewis and Clark County. Existing Capacity—50 megawatts Additional Capacity—90 megawatts (peaking) Located 17 miles northeast of Helena on the Missouri River. An additional power plant would be located on the right bank downstream from the existing dam. The powerplant would have a single 90-MW unit operated in conjunction with the 3 existing 17-MW units. The existing operation at the dam would be changed to peaking operation.	Direct Benefits (Annual) Power $8,649,000 Adverse Effects (Annual Cost) Investment $6,573,000 O, M&R 278,000 Total $6,851,000 Net Beneficial Effects $1,798,000 Total Investment Cost $95,480,000	Change in velocities and elevations in the tailwater area could impact the benthic populations, fish spawning sites, and recreation. Pool fluctuations in Hauser Reservoir could change the releases being made from Hauser Reservoir, which could affect the fisheries in Hauser's tailwaters. The pool fluctuations in Hauser may also affect the water levels in Lake Helena. The new discharge may cause: 1) no change, 2) discharge of warmer, surface waters resulting in an expansion of the reservoir's cooler, anoxic lower layers, or 3) discharge of cooler, nutrient laden waters resulting in expansion of the upper warmer layer of water. Possible temporary increase in airborne particulates during construction.	Direct Benefits (Annual) Power $2,162,000 Indirect Benefits (Annual) Employment $2,726,000 Total Annual Benefits $4,888,000 Adverse Effects (Annual) Investment $1,643,000 O, M&R 70,000 Total Annual Cost $1,713,000 Net Beneficial Effects $3,175,000	Project construction is estimated to take 5 years to complete. Total man-years during construction is estimated as 1,640. Direct employment is estimated to be 600. Indirect employment is estimated to be 220. The total peak year population increase is estimated as 1,230. Operation and maintenance of project facilities is estimated to require 8 employees. Earnings in the region would increase as a result of construction purchases and on-site employee earnings. Helena, the largest community in the area, may experience a strain on some of its community facilities and services. As many as 370 units may be required to house the construction and nonconstruction employees and their families. School facilities may also be needed to handle as many as 300 additional students in the peak construction year.

Missouri-Poplar (1006) Fort Peck, Valley and McCone Counties. Present Capacity 185 megawatts Additional Capacity 185 megawatts (peaking) Reregulation Dam Size 45 feet high Reregulation Dam Storage 20,000 acre-feet The maximum discharge capacity at Fort Peck would increase from 15,200 cfs to 32,600 cfs. The dam and reservoir would require 1,290 acres of land in private ownership. An additional 480 acres of land would be purchased to mitigate the impacts of wildlife habitat inundated by the reregulation reservoir. Tailrace recreation facilities would be relocated downstream of the reregulation dam. A new, gated concrete box culvert at State Highway No 249 would prevent stage fluctuations in existing dredgecuts west of the highway	Investment Cost $84,253,000 Annual Cost $5,608,000 Annual Benefits $7,909,000	Reduced stage fluctuations downstream of reregulating reservoir in relation to existing flow regime. Loss of eight miles of river habitat. Change in fish populations in reservoir reach. Reduction in habitat and fishing value of the dredge-cut lakes west of Montana Highway No. 249; 643 acres of existing dredge-cut lakes would be inundated, blocking recruitment of river fish into lakes. Loss of 200 acres of terrestrial habitat in the reregulation reach through inundation, erosion or bank slope adjustment; this includes 50 acres of islands. Reregulation structure and pool would replace a riverine environment with an artificial structure where large sand bars may be created daily.	User Benefits—$7,909,000 Net Benefits—$2,301,000 Acquisition of 1,290 acres of private land for dam and reregulation reservoir. Loss of use of recreation facilities in the eight mile reregulation reach (existing facilities would be relocated downstream.) Substantial increase in peaking capacity and a minimum reduction in average annual energy output. Annual gain would be $8,036,000 versus a loss of $236,700 for a net increase in average annual power benefits of $7,799,300. $5,500 lost per year in taxes on agricultural land. $74,000 lost per year from agricultural land use.	Supplemental skilled and common labor will need to be recruited beyond commuting area. Construction workers and families may place some stress on local community services and facilities. Need four new or refurbished housing units for permanent personnel and families. O&M personnel estimated to total 4 Study area employment peak construction—350 jobs. Operation and maintenance—4 jobs. Value of housing temporarily inflated in nearby communities
MULTI-PURPOSE **Upper Missouri Tributaries (1002)** Boulder River Unit, Jefferson County Irrigable Area New 3,400 acres Supplemental 7,300 acres Total 10,700 acres This multi-purpose project is for full service and supplemental irrigation water, recreation and stream fishery enhancement. There will be a permanent water storage of 2,700 acre-feet for water based recreation and a developed recreational area around the reservoir of 286 acres	Investment Cost $9,557,000 Annual Cost $630,000 Annual Benefits $674,000	Water would be provided for stream fishery enhancement on about 30 miles of Boulder River eliminating dry sections during summer. Stream fishery of 3.6 miles would be inundated on Little Boulder River.	Not available.	Create 90 man-years of unskilled employment Create 35,000 recreation visitor-days and 7,600 fisherman days at the reservoir site. Create 12 permanent semi-skilled jobs and 100 short-term, skilled jobs

Environmental Quality Plan

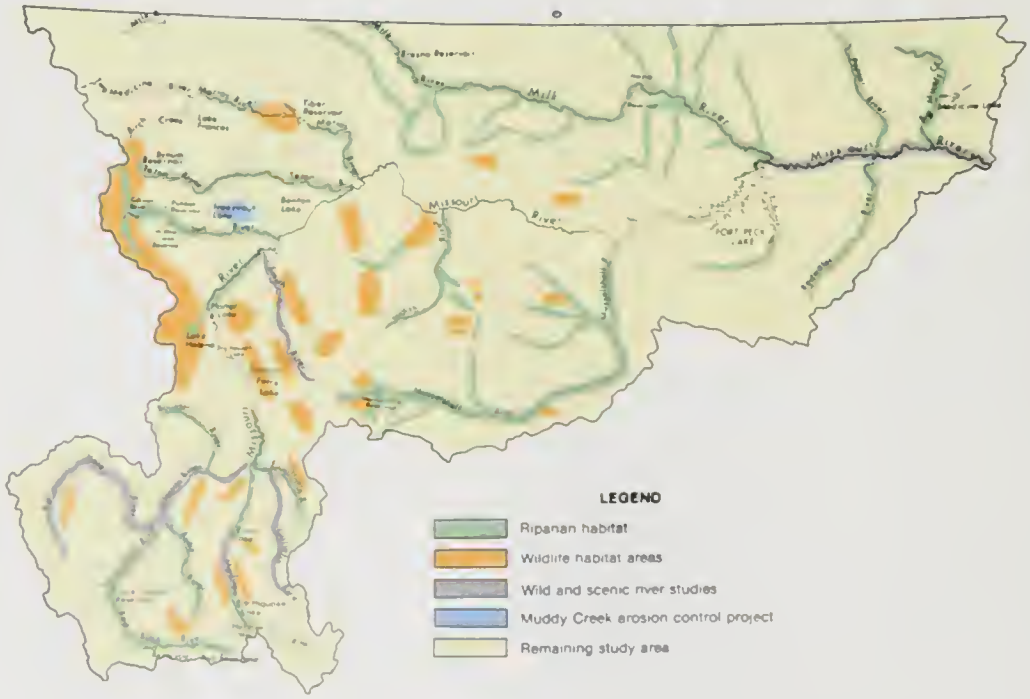
Environmental resources and values refer to those elements of the landscape or water bodies that man must preserve or maintain for their aesthetic as well as production benefits. According to the **Principles and Standards**, the environmental objective is to "enhance the quality of the environment by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems."

Because of the level of detail dictated by this study and the imposed constraint of using existing data, little quantified information was available for the EQ Plan. Evaluation of environmental issues has only been attempted in recent years and thus detailed studies paralleling those related to economic development are lacking. For this reason, much of the material for the environmental elements included here is inqualitative terms. The basic elements of this plan were provided by functional task forces that were formed for this study.

The tables at the end of this section show evaluations of beneficial and adverse effects under the four accounts. Values are expressed in quantitative terms wherever practical. Those EQ plan elements which can be generally located on a map are shown in Figure 12.

Black bear cub along Prickly Pear Creek near Helena.

Figure 12
EQ PLAN



208 Water Quality Management Planning

The Statewide 208 Water Quality Management Program described in Chapter II designates the Conservation Districts as the lead agency for implementing agricultural practices resulting in improved water quality. The program essentially adopted the SCS conservation practice standards as the "208" Best Management Practices in implementing their nonpoint source pollution program. Cost sharing funds will be provided primarily through the ACP and GPCP.

Through the Rural Clean Water Program, the ASCS would provide cost-sharing assistance to farmers and ranchers within a designated project area. To receive funding, the Montana ASCS office, in cooperation with a state multiagency coordinating committee, must select a project area associated with agricultural nonpoint pollution. The proposed project must then receive national funding approval before best management practices can be applied to improve water quality in the receiving stream.

Muddy Creek and Ennis Lake

Both Muddy Creek and Ennis Lake were identified as being major water pollution problems in the study area.

A task force has been formed to seek solutions to the Muddy Creek pollution problem. Its membership includes the ASCS, SCS, EPA, WPRS, and CE at the federal level, the state departments of Health and Environmental Sciences, Natural Resources and Conservation, and Fish, Wildlife and Parks, and Teton and Cascade County Conservation Districts and Greenfield Irrigation District at the local level. An application for Rural Clean Water Program funding for Muddy Creek is being prepared.

Ennis Lake was formed by the construction of Ennis Dam. This shallow water body creates warmer water temperatures than that of the Madison River, resulting in thermal pollution below the dam. Four alternatives were identified as possible means to lower the water temperature of the reservoir. These alternatives emphasized increasing the depth of the lake or increasing the flow through the reservoir. Because of a lack of detailed information, no alternative solution was selected.

Population concentrations along major rivers and their potential for property damage often justifies the high capital costs of protecting structures. The construction of conventional streambank erosion control works on a broad scale for protection of agricultural land can rarely be economically justified.

Serious streambank erosion is occurring on approximately 400 miles within the study area, much of it along tributaries. Several experimental programs have shown that streambank revegetation may be effective in reducing soil losses and resultant water quality degradation. The Forest Service, Corps of Engineers, and Soil Conservation Service are involved in programs designed to evaluate the effectiveness of revegetation techniques. The Corps of Engineers has been directed to establish a national streambank erosion prevention and control demonstration program. The EQ Plan recommends continuation of these research efforts. It also suggests agencies responsible for implementing erosion control measures consider this approach on those specific sites which appear to lend themselves to such methods.

Fish and Wildlife

Several programs are designed to enhance fish and wildlife populations of both direct and indirect value to man. Habitat preservation is the element common to all of these programs. Programs are categorized according to reasons for their implementation.

Habitat Modification

Title II of the Sikes Act (P.L. 93-452) was designed to aid in fish and wildlife habitat improvement on public lands. Although passed in 1974, no funds were appropriated to carry out these programs. A large number of projects have been identified as eligible for funding by the Forest Service and Bureau of Land Management. The EQ Plan recommends that funding be provided to implement provisions of the Sikes Act.

Stockwater ponds that are federally assisted may be modified at little cost to provide for resident wildlife needs. The U.S. Forest Service or Bureau of Land Management in the case of public land, or the Soil Conservation Service on private lands, are re-

sponsible for the construction or assistance in providing these modifications. These modifications include increasing water areas, providing cover, and livestock exclosure fences for protection of wildlife and habitat.

Habitat Preservation

Two programs are, or could be, designed to identify and preserve, or simply maintain, existing fish and wildlife habitat. These are the programs designating critical habitat for endangered and threatened species and a program to inventory riparian habitat.

As indicated, recovery plans are in various stages of completion for the endangered and threatened species. Once this is complete, habitat designation would provide some measure of protection for listed species.

Ferrets peering from burrow.

One of the important wildlife zones most actively developed by man and one needing protection is that of streamside vegetation or the riparian habitat. The identification and preservation of riparian zones may be accomplished by several existing means. The use of zoning, best management practices, conservation easements, and outright purchase are some of the methods in effect to protect these areas. A base line inventory is needed to determine the extent and rate of riparian habitat loss.

Preserving existing aquatic habitat for viable fish populations is the goal of several federal, state, and local interest groups. Studies by the Montana Department of Fish, Wildlife and Parks, establishing optimum aquatic streamflow volumes for fish and wildlife, have been completed for many of the state's streams, including several in the study area. Under Montana law, public bodies may reserve a certain volume of water for future beneficial use. A recommendation allowing for the voluntary transfer of existing water rights to instream use is one potential means of maintaining streamflows for fish and wildlife. However, flow reservations are no guarantee of available water volumes. Prior appropriators can divert this water during low flow periods and substantially diminish "reserve" water volumes.

Habitat Acquisition

Critical wildlife winter range areas exist in most of the study area's mountainous regions. These are considered priority areas for purchase by the Montana Fish, Wildlife and Parks Department. Sufficient funding for purchase is a problem. More important, however, is finding willing landowners from whom to purchase or lease these critical land areas. The EQ Plan supports an 80 percent acceleration of the ongoing Fish, Wildlife and Parks Department's program of land acquisition to meet wildlife range needs.

Outdoor Recreation

Many recreation sites, particularly those within reasonable driving distances of urban centers, are receiving heavy recreational use, while other sites within the area receive little or no use because of lack of access or facilities.

Winter range is critical for wildlife.

Access

Accessibility is the key factor in establishing successful recreation use areas and an indispensable element in the recreation planning of state and federal agencies.

The EQ Plan includes a recommendation for development of access roads to public land recreation areas. To minimize under- and over-utilization of recreation areas, management agencies need to set and enforce carrying capacity limitations and encourage use of underutilized areas.

Site Preservation

State and federal regulations require the identification of historic and cultural properties of national, state, and local significance which may be eligible for listing on the National Register of Historic Places. Federal legislation authorizing the preservation of historic landmarks requires the review of any Federal, or federally-assisted, action potentially impacting specific sites and recommendations to minimize possible adverse impacts. Amendment of the State Antiquities Act to include this review process is proposed to provide added protection to historic sites on or eligible for the National Register of Historic Places. Similar legislation should be adopted at the state and national level for the protection of natural landmarks of state or national significance. There presently is no state or federal authority to protect these sites.

Corridor Preservation

Development usually occurs adjacent to water bodies. Subdivisions, highways, powerlines, dams, and access roads leave few reaches of major rivers in a pristine condition. The national wild and scenic rivers system emphasizes the use and protection of such river reaches for their recreational benefits.

Rivers that could be included in this system are first recommended for study. These studies determine the degree of unobstructed flow, scenic quality, adjacent development activity, and access. Those rivers, or sections of rivers, considered eligible on the basis of the studies may be recommended as wild and scenic, subject to congressional action. Those streams recommended by the EQ Plan for initial study are shown in table 33.

Land Use

The inventory of existing resources, determining optimum locations for different land uses, and the use of zoning as a tool to provide more certainty in guiding these decisions, are all part of land use planning.

Looking across the Beaverhead River at Beaverhead Rock.

The inventory of resources is acknowledged as an acceptable process by the public. Plan implementation through zoning, or other means of allocation, however, are viewed by some as a land use restriction.

Comprehensive Land Use Planning

While city-county and county land use plans are in various stages of completion in most counties in the study area, few have implemented completed plans beyond their city or town boundaries. Many counties without comprehensive plans would benefit by completing a base line inventory of their existing resources and keeping it current as a prelude to future planning. Such basic resource information would benefit those counties facing potential oil, gas, and coal development.

Flood Plain Management

Flood insurance is mandatory within defined flood-prone boundaries if the communities involved wish to remain eligible for federally-insured mortgage loans and federal disaster assistance. The need for flood plain surveys, particularly in areas facing urban expansion, will require additional personnel and funding under the Department of Natural Resources and Conservation's Flood Plain Management Program.

Land and Water Conservation

Land and Water Conservation Measures

Land and water conservation measures, commonly termed "soil and water conservation practices, "have been applied for the last 40 years primarily for the purpose of preserving the soil resource base. In recent years, however, emphasis towards water quality and protection of the environment has increased.

Examples of these practices include rotational cropping, reestablishment of grazing cover, vegetational windbreaks, stubble mulching, stripcropping, grassed waterways, and sediment retention structures. Essentially, these practices are identical to those recommended in the 208 Plan. However, irrigation management practices are not included in this EQ plan element.

Implementation of a 25 percent increase in present land treatment rates would be accomplished by increased funding through the Agricultural Conservation Program (ACP), small watershed program, and the Great Plains Conservation Program (GPCP) on private lands. Public land treatment would occur through programs of the BLM and FS.

Saline Seep

The increasing incidence of saline seep is a serious resource and economic problem. Most saline seep can be controlled by changing farming practices on seep recharge areas. Suggested practices include establishing deep-rooted perennial crops and growing annual crops when soil moisture is available.

A continued intensive educational program, technical assistance to landowners, and additional research on seep areas, can prevent or significantly reduce saline seep. Currently, assistance is being provided landowners to alleviate seep areas in the Triangle Conservation Districts area. Two or three other large geographic areas within the study area, excluding area 1002, are in need of similar programs. The EQ Plan is recommending an expansion of the current program to these additional areas. The major intention in alleviating saline seep is for reducing the loss of the resource base. The State 208 Water Quality Management Plan identified saline seep as a major resource problem.

EQ Recommendations

Many of the proposals presented to address environmental problems and issues lacked sufficient detail to be displayed as a plan element. In several cases, they were merely proposals for study. The recommendations and the actions suggested are discussed in the following section.

Streambank Erosion Control

The Corps of Engineers has primary responsibility for development of streambank erosion control methods. The Forest Service and Soil Conservation Service have established a pilot program of streambank revegetation in Teton County. Additional research and development should be continued by these agencies to determine its full potential.

Upon satisfasctory completion and documentation of the results, guidelines provid-

ing information on the use of revegetation as a technology for desired control should be made available to planners. Agencies with responsibilities for implementing, administering and reviewing dredge and fill activities under Section 404 of P.L. 92-500, the Federal Water Pollution Control Act, and under SB 310, Montana Natural Streambed and Land Preservation Act, should also be encouraged to consider this alternative when it is less costly but still effective and where environmental results are more desirable.

Recreation

Public land managing agencies within the Departments of the Interior and Agriculture and the State of Montana, which are responsible for public recreation areas, should provide better management of these areas. These activities include: 1) limit the use of all public recreation areas to their carrying capacity, 2) encourage use of underutilized recreation areas, and 3) provide access to winter-use areas and to public lands through public and private property. The Forest Service should accelerate its efforts by providing 491 miles of additional access roads. The estimated costs of this access are: $12.5 million, right-of-way acquisition; $19 million, access construction; $14.7 million, total recreation budget and facilities construction; $2.5 million, 491 miles of access roads; total of $48.7 million.

The Montana Legislature should amend the Antiquities Act of 1979 and allow for the implementation of programs and policies to apply regulations similar to those in P.L. 80-665 (National Historic Preservation Act) and Executive Orders 11593 and 36 CFR 800 for state-local actions affecting sites on or eligible for the National Register of Historic Places.

State and federal legislation should be enacted and programs and policies implemented to apply regulations similar to P.L. 89-665 (National Historic Preservation Act of 1966) and related executive orders to federal, state and local actions affecting sites on or eligible for the National Register of Natural Landmarks.

The Department of Fish, Wildlife and Parks, in cooperation with the Heritage Conservation and Recreation Service, should draft legislation that will provide for the protection of all natural landmarks of state or national significance.

The Departments of the Interior and Agriculture, in cooperation with the State of Montana, should study selected river segments as potential additions to the wild and scenic rivers system to evaluate their outstandingly unique characteristics. Rivers which appear to have potential for wild and scenic study are: 1) Big Hole, 2) Gallatin, 3) Smith, 4) Jefferson, 5) Missouri—Fort Peck Dam to North Dakota border, and 6) Madison—Ennis Reservoir to McAttee Bridge.

Canoeing is a popular pastime on Montana streams

Table 33
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
EQ PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
WATER QUALITY				
Study Area Implement the nonregulatory programs described in the State and the Blue Ribbon 208 Water Quality Management Plans for nonpoint source water pollution abatement.	Costs of best management practices that would be installed for prevention of nonpoint pollution.	Improved downstream water quality for all uses. Improve general aesthetics of the land. Additional reduction of soil loss and sediment yield above future-without condition. Increased vegetative cover resulting from improved management of existing resources. Improved quality of fish and wildlife habitat, including cover, forage, watering places, waterfowl nesting sites, and establishment of fisheries. Reduce soil nutrients from entering streams and the ground water Reduction of undesirable return flows to streams. Additional depletion of streams due to increased consumptive use by added vegetative cover. Increased fire hazard from added production of forage plant species.	Maintain and/or enhance the output of goods and services to users in the region.	Enhancement and maintenance of vital soil and forest resource base for future generations. General enhancement of the human environment. Provide additional employment in the application and maintenance of proposed measures. Provide additional permanent employment in processing increased goods and services.
Missouri-Marias (1003) Muddy Creek (Cascade and Teton Counties). The Muddy Creek Task Force[a] should develop a solution to the hydraulic, sediment, nutrient, and funding problems associated with Muddy Creek. The following solutions are now being considered by the task force. 1. **On-farm Management including:** a) improved water distribution systems, b) improved watershed and stream corridor management, c) increased cost-sharing and modified component pact rule, and d) increased technical assistance. 2. **Supply Canal Relief**—use of Freezeout and Priest Lakes for excess runoff relief.	Direct Benefits (Annual) Irrigation $1,000,000 Flood Control 50,000 Fish & Wildlife 50,000 Recreation 50,000 TOTAL $1,150,000 Adverse Effects (Annual) Investment $1,840,000 O, M&R 80,000 TOTAL $1,920,000 Net Beneficial Effects $-770,000 Total Investment Cost $26,700,000	Stabilize more than 30 miles of stream banks (60 bank miles). Improved management of rangeland would benefit wildlife. Streambank stabilization would permit growth of riparian vegetation and increased fur-bearing population. IMS program would result in reduced fertilizer applications and energy consumption. Improved farming methods and changes in project operation might result in reduced diversions from Sun River. Reduced sediment load in Muddy Creek and Sun River. Reduced sediment amounts of contaminant-loaded return flows.	Direct Benefits (Annual) Irrigation $1,000,000 Flood Control 50,000 Fish & Wildlife 50,000 Recreation 50,000 TOTAL $1,150,000 Indirect Benefits (Annual) Irrigation $600,000 Employment 848,000 Total Annual Benefits $2,598,000 Adverse Effects (Annual) Investment $460,000 O, M&R 80,000 TOTAL ANNUAL COST $540,000 Net Beneficial Effects $2,058,000	Construction period will last 2-3 years. Total man-years during construction is projected to be 372. Total direct and indirect employment in the peak year of construction is 255. Projected population increase is 390. Great Falls is the largest city in the project area. The increased population from the project construction (390) would not be expected to have significant effect on the community services of Great Falls. However, Choteau and Vaughn may be adversely affected if a large portion of construction workers move into these towns. O&M personnel estimated to total 3.

3. **Muddy Creek Channel Stabilization and Rehabilitation**—implement erosion control measures in the stream, like the current Water and Power Resources Service's demonstration project. 4. **Interceptor Canal**—construct a canal to parallel Muddy Creek on the west side to intercept irrigation return flows. 5. **Greenfields District Operation and Maintenance**—existing efficiency program (radio communications, canal lining, and flow monitoring) should be continued. 6. **Information and Education Program**—inform and educate all those involved (e.g. farmers, local residents, ranchers, local officials, local groups). 7. **Funding Strategy**—pursue both a special congressional appropriation and a multi-source funding scheme.		Improved range condition and reduced stream meandering would result in reduced wind erosion. Visual impacts of 2½-mile long, surge canal to Freezeout Lake and 14-mile long, interceptor canal paralleling Muddy Creek. Canals would interrupt wildlife movement routes and eliminate about 100 acres of rangeland habitat. Temporary dust problem during construction; would be minimized by watering.		

[a]Membership from DNRC, WQB, DFWP, ASCS, SCS, EPA, WPRS, CE, Greenfield Irrigation District, Teton and Cascade County Conservation Districts

WATER QUALITY **Upper Missouri Tributaries (1002)** Eliminate thermal pollution in Madison River below Ennis Lake (Madison County). Four alternatives are suggested				
1) Dredge Ennis Lake and construct a dike	Investment Cost $2,130,000 Annual Cost $197,000 Annual Benefits $0	Lower water temperatures downstream, creation of goose nesting areas and improved water quality. There would be a visual impact of dikes and the east side would be isolated from the rest of the lake.	User Benefits $0 Regional Benefits $94,000 Net Benefits $103,000	25 vacation homes lost
2) Install canal around Ennis Lake	Investment Cost $19,855,000 Annual Cost $1,377,000 Annual Benefits $0	Lower water temperatures downstream, preservation of Blue Ribbon qualities; diversion dam would restrict fish movement; loss of terrestrial habitat.	User Benefits $0 Regional Benefits $600,000 Net Benefits $777,000	Relocation of 4 homes Small permanent part-time job construction would benefit Ennis A peak of 500 persons would come to local community
3) Raise height of Madison Dam	Investment Cost $27,900,000 Annual Cost $2,080,000 Annual Benefits $1,960,000	Colder downstream temperatures, additional seven sections of flat water, inundate two to three miles of Madison River and six sections of land, prime trout spawning area may be destroyed	User Benefits $1,960,000 Regional Benefits $870,000 Net Benefits $1,210,000	Not available
4) Change in reservoir operation	Some loss of energy generation.	Development of mud flats, lower water temperature.	Not available.	Not available

Table 33 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
EQ PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
FISH AND WILDLIFE				
Study Area The Congress should appropriate funds for the implementation of fish and wildlife programs on public lands (Sikes Act, P.L. 93-452). 690 projects on 161,300 acres. Action includes: **Wildlife**—1) prescribed burning, 2) seeding and planting, 3) water development, 4) developing browseways and openings, 5) providing nest structures, 6) control fencing, 7) vegetation release and pruning 8) game access. **Fish**—1) barrier removal, 2) streambank stabilization, 3) channel structures, 4) construction of lakes and 5) spawning beds.	Investment Cost $7,839,000 Annual Cost $696,000 Annual Benefits $621,700	690 projects on 161,300 acres for wildlife habitat improvement. The target species categories benefiting are: (1) endangered or threatened (2) big game (3) upland game (4) fur bearers (5) nongame (6) fish Wildlife population densities and distribution will improve.	User Benefits $621,700 Regional Benefits $62,000 Net Benefits -$12,300	Provide 100 temporary semi-skilled positions for five year period. Increased recreation benefits.
Install measures that will enhance wildlife habitat near existing and future federally-assisted stockwater ponds. Accelerate measures on public lands by 60 percent. 1,150 ponds will receive measures designed to improve wildlife habitat and population. On private land, installation of measures would be voluntary for future federally-assisted ponds. Measures include: 1) pond clusters and nesting islands to include shoreline habitat and nesting areas. 2) fencing to exclude livestock (upper, shallow portion or all of ponds) 3) inclined access ladder, escape ramps and floating platforms in stocktank to reduce wildlife mortality 4) concrete wildlife water basins 5) deferred or rest-rotation grazing systems to augment vegetative cover and food sources.	Investment Cost $403,000 @ $350/pond Annual Cost $37,600 Annual Benefits— Not determined Possible increase of wildlife damage to cultivated crops and fields due to augmented numbers.	Increased wildlife and waterfowl populations. Improved water quality. Improved conditions for livestock watering and reduction of sacrifice area surrounding ponds.	Not available.	Possible increase in landowner-sportsman conflict due to added numbers of the latter.

The Secretary of the Interior should designate critical habitat, if appropriate, for threatened or endangered species to help assure that impacts of development on these species are considered adequately in all federal development and planning activities. Authorization exists under the Endangered Species Act of 1973 as amended (P.L. 93-205) Species for which critical habitat should be considered: bald eagle and peregrine falcon—all planning areas gray wolf—all planning areas, except 1004 grizzly bear—all planning areas, except 1004 and 1006 black-footed ferret—all planning areas, except 1002 and 1003.	Loss of food, fiber, mineral development, and services foregone because of restricted development and use of natural resources.	More environmentally sensitive management of public lands could occur. Habitat preservation would ensure better survival of endangered species. Protection of ecosystems may include long-term maintenance of natural resources (i.e., water quality, air quality, reduced timber harvest, and grazing impacts from federal projects).	Potential indirect changes in grazing practices, rescheduling of logging practices, regulation of logging road construction and utilization, seasonal restrictions on mineral exploration and changes in recreation patterns to avoid conflicts with threatened or endangered species. Potential increase in reforestation or increased timber harvest where over-mature and closed overstory are detrimental to species management due to fire suppression policies. Loss of income and employment foregone by restricted use of natural resources.	Potential for stricter supervision of recreating public. Clarification of critical habitat concerns. Public awareness of endangered species would aid in protection and resources would be conserved for future generations. Loss of potential jobs and economic stability.
Preserve and enhance riparian habitat through a multi-purpose program approach. 1) Inventory of riparian habitat. 2) Recognize the importance of Executive Orders #11988 (Floodplain Management) and #11990 (Wetlands Protection). 3) Study wild and scenic river segments for potential designation. 4) All 208 Water Quality Management Plans should consider riparian vegetation protection when adopting best management practices. 5) Local governing bodies should identify and designate riparian lands. 6) Restrictions on funding for programs that are now cost-shared by governmental agencies should be adopted unless appropriate "BMP's" including riparian habitat protection are adopted on applicant's land. 7) The importance of "green belts" and their associated riparian values should be recognized in all phases of urban flood plain planning. 8) New legislation to provide authorization and subsequent appropriation to secure easements or fee title acquisition is requested (land acquisition). [a]$3,000/A. to NED	Riparian Land Acquisition Investment Cost $1,325,820,000[a] Annual Cost $112,000,000 Annual Benefits —Not determined Increased costs of any further irrigation diversions development and maintenance. Benefits from stream fishery recreation. Hunting benefits.	Total acreage 441,940 acres Habitat and associated fish and wildlife species preserved. Improved water quality. Streambank stability, reduced soil erosion, increased natural beauty. Benefits from streambank protection, water quality improvement, soil stability and wildlife.	Small local economic gain, increase in natural areas and amenities, local recreation. Increase in land values near preserved areas. Improved water quality and reduced treatment costs. Less land available for agricultural, industrial, residential development in riparian zone. Change in trend of tax base. Some income and employment loss from decreased crop and livestock production.	Stream recreation opportunities. Conflict between private landowner and general public. Reduction in tax base.

Table 33 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
EQ PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
FISH AND WILDLIFE				
Study Area				
Provide assured, adequate instream flows for fish and wildlife. 1) Provide high aquatic flows through ongoing water reservation process (see Instream Flow Evaluation for Selected Streams in the Upper Missouri River Basin, Montana Department of Fish, Wildlife and Parks, March 16, 1979). 2) Enact state legislation to authorize the transfer and change of water rights from agricultural, industrial and municipal purposes to maintenance of instream flows where mutual agreement can be achieved.	Losses of income from irrigation and energy development foregone because of restricted use of natural water and related land resources.	Guarantee of viable fish and game populations due to minimum flow standards. Improved water quality from increased low flow volumes.	Decreased water treatment costs. More water available for downstream states' use. Potential losses of net profit and employment in some areas from other uses of water. Inefficient hydropower generation due to reservation enforcement.	Improved scenic beauty and water quality. Increased recreation.
Planning Areas 1002, 1003 and 1004				
Accelerate wildlife area acquisition by 80 percent of the ongoing rate through DFWP acquisition program.[b] 200,000 additional acres would be acquired as a result of the accelerated program through year 2000.	Investment Cost $60,000,000[a] Annual Costs $5,091,000 Annual Benefits—Not determined. Decrease in wildlife damage to adjacent lands. Hunting benefits.	Acquisition of 200,000 acres would improve wildlife habitat. Improve water quality.	Improve grazing practices. Increased recreation benefits. Increase in natural areas. Loss of agricultural production. Less land available for agricultural, industrial and residential development.	Improved opportunities for viewing and hunting. Decrease in landowner-sportsman conflict. Change in land ownership.

[a]Average cost of wildlife habitat is $300/acre.

[b]The current rate of acquisition is 10,000 acres a year. The EQ Plan would accelerate that rate by 8,000 acres a year or 80 percent.

LAND USE PLANNING **Study Area** Amend legislation to require the adoption of county and state comprehensive land use planning and mandatory county zoning by the year 2000. Amend legislation at the state level to require the adoption of county and state comprehensive land use plans for mandatory county zoning and for joint and stricter enforcement of appropriate land use control mechanisms such as county zoning Suggested Methods of Implementation: 1) Ensure stricter enforcement of appropriate land use control mechanisms, 2) Joint county and state comprehensive planning with strict enforcement of zoning regulations; appropriate zones set up after the planning with systematic review over time, 3) Incentive systems for discouraging inappropriate land use; the most common incentives are tax related, 4) Acquisition of development rights to certain lands by public bodies; and 5) Close loopholes in Subdivision and Platting Act of 1973 as recommended in January, 1973, DCA report, **Land Division in Montana, The Subdivision and Platting Act in Practice.**	Costs of planning, enforcement and litigation — total extent unknown.	Identification and preservation of riparian habitat. Maintenance of scenic beauty. Greater efficiency in the use of resources will result in their conservation.	Cost of inventory, planning enforcement (zoning). Restrictions on land use resulting from zoning Preservation of agricultural land areas.	Establishment of planned growth areas and segregation of incompatible use. Local goal setting will result in greater local self-reliance and determination of future activities
The Montana Legislature should increase funding for the Flood Plain Management Program (DNRC) to assist in determining the 100-year frequency floodway and flood plain boundaries for streams in the study area and to manage and regulate flood-prone lands and waters to prevent or alleviate flood threats to life and property.	Initial Cost $40,000[a] Reduced flood damages. Hunting benefits.	Preservation of open space for recreation, fish and wildlife values. Improved water quality. Reduced health problems due to contaminated water.	Maintenance of agricultural base for community/region. Lowered land values due to restrictive zoning. Restriction of construction activities in flood zone.	Preservation of open space for area resident enjoyment Reduced flood damages Protection of agricultural land areas

[a]Costs include the hiring of one engineer to coordinate the National Flood Insurance Program and additional funds to contract for flood plain delineation studies. The cost of such studies generally runs about $1,000/mile. No determination was made of the duration of the program.

Table 33 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
EQ PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
LAND AND WATER CONSERVATION				
Study Area Accelerate ongoing land and water conservation measures by 25 percent.[a] Additional Acres Treated State and Private 1,089,636 BLM 390,000 FS 33,500 Other 7,000 Total 1,520,136 Examples of such measures include rotational cropping, reestablishment of grazing cover, vegetational windbreaks, contour and wind stripcropping, stubble mulching and grassed waterways. [a]Excludes irrigation practices.	Investment Cost (State and Private) $19,533,000 Investment Cost (BLM) $5,716,000 Investment Cost (FS) $4,680,000 Investment Cost (Other) $172,000 Total Investment Cost $30,101,000 Total Annual Cost $3,153,000 Annual Benefits—not available.	Improved downstream water quality for all uses. Improve general aesthetics of the land. Additional reduction of soil loss and sediment yield above future without condition. Increased vegetative cover resulting from improved management of existing resources. Improved quality of fish and wildlife habitat, including cover, forage, watering places, and waterfowl nesting sites. Reduce soil nutrients from entering streams and the ground water. Reduction of undesirable return flows to streams. Additional depletion of stream flows due to increased consumptive use by added vegetative cover. Increased depletion of water resulting from added surface evaporation from ponds. Increased fire hazard from added production of forage plant species.	Maintain and/or enhance the output of goods and services to users in the region.	Preservation of the resource for future generations. Provide additional employment in the application and maintenance of proposed measures. Provide additional permanent employment in processing increased goods and services.

LAND AND WATER CONSERVATION **Study Area** The DNRC should seek additional funding sources for saline seep prevention, abatement and research. Potential Appropriation sources: 1) The State Legislature should appropriate additional funding to the Renewable Resource Development Program, and/or 2) Obtain grant monies from the Old West Regional Commission to be channeled through the Conservation District Division to the conservation districts.	Investment Cost $6,000,000 Annual Cost $284,800 Annual Benefits —Not available.	Two to three geographic areas would have improved water quality and soil resource. Improved downstream water quality for all uses. Improve general aesthetics of the land. Additional reduction of soil loss and sediment yield above future-without condition. Increased vegetative cover resulting from improved management of existing resources. Improved quality of fish and wildlife habitat, including cover, forage, watering places, waterfowl nesting sites, and establishment of fisheries. Reduce soil nutrients from entering streams and the ground water. Reduction of undesirable return flows to streams. Additional depletion of streams due to increased consumptive use by added vegetative cover.	Maintain and/or enhance the output of goods and services to users in the region.	Preservation of the resource for future generations Provide some additional employment in the application and maintenance of proposed measures. Provide additional permanent employment in processing increased goods and services

Additional Alternatives

In the process of developing NED and EQ Plans, many alternative solutions were analyzed in an effort to develop the best plans. Some of these analyses were rudimentary, others were more detailed. Some of the alternatives analyzed did not meet the criteria required for inclusion in the NED or EQ Plans and are discussed in this section.

Table 34 lists the various alternatives which were analyzed as well as the reasons they were excluded from the NED or EQ Plans. Elements which were controversial or generated considerable local support and interest are briefly described in the following paragraphs.

Jefferson-Whitehall Unit—Upper Missouri Tributaries Planning Area

This potential unit was planned to provide irrigation water to benches along the Jefferson and Missouri Rivers. The total acreage proposed for irrigation was 64,210 with 49,615 new acres and 14,595 supplemental acres. Storage of water for the unit would be provided by the proposed 500,000 acre-feet Reichle Dam and Reservoir on the Big Hole River. In addition, a small off-stream regulating reservoir was planned for Milligan Creek near Three Forks. Extensive supply canals would be required with the initial section 56 miles in length, running from a diversion dam on the Jefferson River to Milligan Reservoir. The terminal canal from Milligan Reservoir to near Canyon Ferry Dam would be 84 miles in length. The project proved to be economically infeasible and also received considerable opposition from environmental interests. Alternate plans which considered pumping to the lands rather than gravity service were also analyzed and found to be infeasible.

Sun-Teton Unit—Missouri-Marias Planning Area

The Sun-Teton Unit was proposed for flood control and irrigation in the Sun and Teton River Basins. Four damsites were analyzed which would provide varying levels of irrigation service and flood control. The four sites analyzed were Lower Sun Butte, Castle Reef, Lowry, and Gilman. All four sites proved to be infeasible by wide margins as shown in table 34.

Local interest in this unit was significant since the Sun River Basin has sustained some of the greater flood damages historically.

The Floweree Damsite investigated by the Corps of Engineers is identical to the Lowry site analyzed by the Water and Power Resources Service. Analysis of Floweree showed it to be infeasible.

Musselshell Unit—Missouri-Musselshell Planning Area

This unit would provide irrigation for lands along the Musselshell River between the town of Musselshell and Fort Peck Reservoir. The dam would be located just above Musselshell on Hawk Creek. Water would be pumped into the reservoir from the Musselshell River during periods of high flow. Irrigation would be provided for 14,800 acres of new land and 7,700 acres of supplemental land. Some flood storage would be included in the reservoir and a pumping plant and diversion dam would also be required. Initial analysis showed the project to be infeasible.

Milk River Supplemental—Milk Planning Area

Alternative #1 consisted of an outlet tunnel at Elwell Reservoir discharging into an 80-mile canal extending to Fresno Reservoir. A bifurcation structure would release water enroute to Big Sandy Creek. The new lands irrigated would total 72,700 acres and supplemental service would be provided 108,140 acres in the Milk River valley. The alternative providing service to new lands was found to be infeasible.

Alternative #3 involves a pump lift from the Telegraph Creek arm of Fort Peck Reservoir into a 60-mile canal terminating at Nelson Reservoir. Only 2,000 acres of new land would be served under this scheme along with 108,140 acres of supplemental service in the Milk Valley.

Alternative #4 would involve a 31-mile gravity canal from Duck Creek arm of Fort Peck Reservoir terminating near Vandalia. This scheme would provide service to 19,000 acres of new lands and 53,200 acres of supplemental lands. These two alternatives were not as economically efficient as the one selected for the NED Plan.

Missouri River Navigation

The possibility of developing navigation on the Missouri River was suggested by several citizens in their review of the planning activities. The need for alternative transportation facilities because of the possible loss of railroad facilities was pointed out. The potential for extending navigation up the

Missouri above Sioux City, Iowa was analyzed. This would require several locks and dams to be constructed around the existing mainstem dams and reservoirs. Two routes were analyzed. One route would follow the Missouri River through the reservoirs to Fort Benton. The other would use the James River in North and South Dakota and a proposed canal to bypass several of the mainstem reservoirs. Neither route was found to be economically feasible.

Table 34
POTENTIAL ELEMENTS ANALYZED BUT NOT INCLUDED

Planning Area and Potential Element	Primary Purpose and/or Features	Reason for Omission From Alternative Plans
Upper Missouri Tributaries		
Blacktail Unit	Irrigation—Landon Dam and Reservoir on Blacktail Creek	B/C = 0.3
Jefferson-Whitehall Unit	Irrigation—Reichle Dam, Milligan Dam, Jefferson Diversion Dam	B/C = 0.5
Madison Unit	Irrigation—Madison Diversion Dam on Madison River, Canals, 16,500 foot tunnel	B/C = 0.7
Three Forks Local Flood Protection	Flood Protection Levee	B/C = 0.8
Missouri-Marias		
Sun-Teton Unit	Irrigation and Flood Control	
	Lower Sun Butte Dam	B/C = 0.5
	Castle Reef Dam	B/C = 0.4
	Lowry Dam	B/C = 0.2
	Gilman Dam	B/C = 0.3
Ulm Unit	Irrigation—Pumping from Missouri River	B/C = 0.8
Dry Fork Marias Damsite	Flood Control	B/C = 0.2
Cut Bank Creek Damsite	Flood Control	B/C = 0.2
Cottonwood Creek Damsite	Flood Control	B/C = 0.3
South Fork Teton River Damsite	Flood Control	B/C = 0.2
Teton River, Lower Damsite	Flood Control, Hydropower	B/C = 0.8
Floweree Butte Damsite[a]	Flood Control	B/C = 0.1
Simms Creek Damsite	Flood Control	B/C = 0.1
Big Coulee Damsite	Flood Control	B/C = 0.1
Muddy Creek Damsite	Flood Control	B/C = 0.1
Elk Fork Damsite	Flood Control	B/C = 0.1
Fort Benton Watershed Project	Flood Prevention for Fort Benton	Local Interest Lacking
Fort Benton Unit, Alternative #1	Hydropower and Irrigation for 8,700 acres—Dam and afterbay dam on Missouri River	More Efficient Economic Alternative Afterbay in scenic reach
Fort Benton Unit, Alternative #2	Hydropower—Dam and afterbay dam on Missouri River	More Efficient Economic Alternative Afterbay in scenic reach
Pondera Creek Watershed Project	Flood Prevention for Conrad	Local Interest Lacking
Cottonwood Creek Watershed Project	Flood Prevention for Chester	Local Interest Lacking
Missouri-Musselshell		
Musselshell Unit	Irrigation—Hawk Creek Dam	B/C=0 8
Roundup Local Flood Protection	Flood Protection Levee	B/C=0 4
Musselshell Local Flood Protection	Flood Protection Levee	B/C=0 4
Milk		
Milk River Supplemental		
Alternative #1	Tunnel and Canal from Elwell Reservoir to Fresno Reservoir, Irrigation of 108,140 A.	More Efficient Alternative
Alternative #3	Pumping from Telegraph Creek arm of Fort Peck	More Efficient Alternative
Alternative #4	Canal from Duck Creek arm of Fort Peck, Irrigation of 19,000 acres new, 53,200 acres supplemental	More Efficient Alternative
Thirty-Mile Creek Watershed Project	Flood Prevention, Irrigation and Recreation	Local Interest Lacking
Fort Belknap Watershed Project	Drainage	Local Interest Lacking
Paradise Watershed Project	Drainage	Local Interest Lacking
Malta Local Flood Protection	Flood Protection Levee	Local Interest Lacking
Missouri-Poplar		
Missouri Diversion Unit	Irrigation—Pumping from Missouri River for 85,200 acres	B/C = 0.7
Missouri-Musselshell & Missouri-Poplar		
Missouri River Navigation	Locks and/or canal—Sioux City to Fort Benton	
	—Missouri River Route	B/C = 0.2
	—James River Route	B/C = 0.2

[a]Identical to WPRS Lowry Damsite

CHAPTER V

THE RECOMMENDED PLAN

This chapter describes the plan selected for management of the water and related land resources in the Upper Missouri River Basin in Montana. The Recommended Plan (RP) is comprised of both plan elements and recommendations. The plan elements represent programs or projects which have been analyzed sufficiently to exhibit potential for implementation. Information pertinent to their capability and probable effects is available for display.

Recommendations, on the other hand, are proposals which appear to have merit for accomplishing some of the desired plan objectives or addressing an identified need or problem, but often are lacking in quantifiable data or demonstrated capability to achieve the desired objective. Some recommendations are merely suggestions to study a problem or condition; others are proposals for funding.

In a level B study, the RP identifies those plan elements which exhibit the best potential for solving the region's water and land resource problems, and also recognizes the capability of plan recommendations to address similar problems or needs, at a broad level. For most RP elements and recommendations, further study or planning is required. As part of this continued planning effort, lead agencies should scope an impact reduction or avoidance process using agencies with appropriate missions or expertise.

Most of the elements which are a part of the Recommended Plan came from the NED or EQ alternative plans without revision. In some cases, these plan elements were modified as they moved from the alternative plans to the Recommended Plan. In other instances, new plan elements or recommendations were developed to meet specific needs or problems which had not been satisfactorily addressed by existing plan elements. Some recommendations resulted from revisions or adjustments in NED or EQ Plan elements. All changes made in these elements and any new elements or recommendations developed are discussed in the following pages.

Display of Plan

The following table (35) lists the RP elements. Those plan elements which can be illustrated are included on the study area map. (Figure 13).

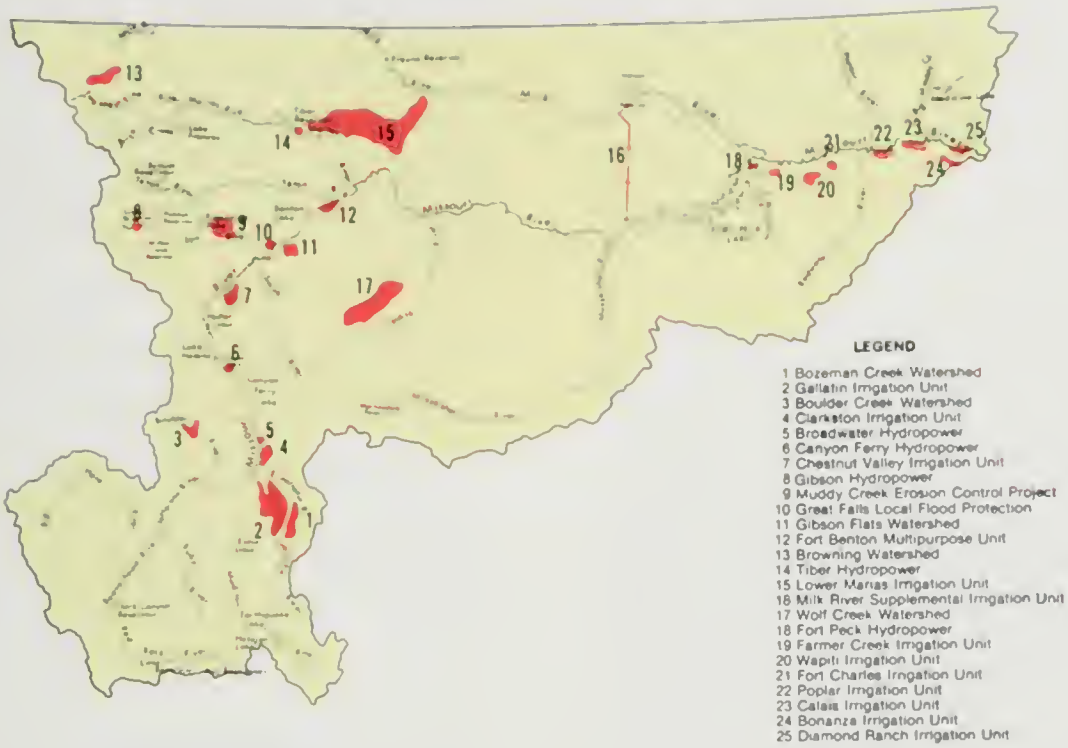
Irrigable lands along the Missouri River near Glasgow

Table 35
RECOMMENDED PLAN ELEMENTS

Plan Function/Element	Purpose	Land/Water Impacts	Initial Cost ($1,000)	Reference Page[a]
Agriculture				
Gallatin Unit	Irrigation	7,957 A. irr. (51,139 sup.)	14,164	103
Clarkston Unit	Irrigation	985 A. irr.	1,098	103
Chestnut Valley Unit	Irrigation	4,470 A. irr. (1,890 sup.)	7,856	103
Lower Marias Unit	Irrigation	127,000 A. irr.	171,110	104
Milk River Supplemental	Irrigation	(108,140 sup.)	32,213	104
Bonanza Unit	Irrigation	800 A. irr.	829	104
Diamond Ranch Unit	Irrigation	900 A. irr.	981	104
Fort Charles Unit	Irrigation	3,187 A. irr.	2,937	104
Calais Unit	Irrigation	6,410 A. irr.	7,586	104
Farmer Creek Unit	Irrigation	888 A. irr.	558	104
Poplar Unit	Irrigation	4,440 A. irr.	5,162	104
Wapiti Unit	Irrigation	3,739 A. irr.	4,143	104
Water Conservation	Irrigation Water Management		266,566	104
Fish and Wildlife				
Implement fish and wildlife programs on public lands	Enhancement of fishery and wildlife habitat	161,300 AC.	7,800	105
Installation of measures at stockwater ponds	Enhance wildlife habitat		403	105
Critical habitat designation	Protection of endangered or threatened species		NA	105
Riparian habitat protection	Preserve and enhance riparian habitat		NA	105
Wildlife habitat protection	Improve and enhance game range habitat		75,000[b]	105
Flood Control				
Bozeman Creek Watershed	Flood Prevention		251	105
Browning Watershed	Flood Prevention	0.7 mi. channel inundated	1,079	105
Great Falls Local Flood Protection Project	Flood Prevention	211 acres land lost	10,122	105
Gibson Flats Watershed	Flood Protection		256	105
Wolf Creek Watershed	Flood Prevention		314	106
Hydropower				
Gibson Power Plant	Hydroelectric Power		10,387	106
Tiber Power Plant	Hydroelectric Power		5,967	106
Broadwater Power Plant	Hydroelectric Power		11,900	106
Canyon Ferry Power Plant	Hydro-peaking Power		95,480	106
Fort Peck Power Plant	Hydro-peaking Power		84,253	106
Land Conservation				
Accelerated Land and Water Conservation	Preserve soil resource Improve water quality	1,520,000 acres treated	19,533	106
Saline Seep	Improve water quality, restore production		6,000	107
Land Use Planning				
Increase funding of Flood Plain Management Program	Accelerate flood plain delineation and regulation		40	107
Water Quality				
Implement 208 programs	Improve or preserve water quality		26,700	107
Muddy Creek	Reduce erosion and sedimentation			
Multi-Purpose				
Boulder River Watershed	Irrigation, recreation, stream fishery	3,400 acres new irr. 7,300 acres supplemental 2,700 acre-feet rec. storage	9,557	107
Fort Benton	Hydropower, Irrigation	8,700 acres irrigated	470,296[c]	107

[a]Page where a more detailed description can be found.
[b]Cost of the current land acquisition program.
[c]Project is presently undergoing a reformulation study; figures are from previous study for illustration.

Figure 13
RECOMMENDED PLAN



Description of Recommended Plan

Plan Elements

Agriculture

All irrigation plan elements included in the NED were forwarded to the RP without change, except for Cameron Bench, Milk River Supplemental Water Supply, and four small units on the Missouri below Fort Peck Reservoir. The Cameron Bench Unit would divert a significant amount of water from the Madison River, resulting in lower flow levels. This reach of the Madison is a popular fishery and is being considered as a possible candidate for a national fisheries recognition system being developed by the Fish and Wildlife Service. Local interest groups are pressing for river protection. Because of these conflicts and the widespread resistance to a proposal which would entail construction of a diversion dam on the Madison River, this unit was not included in the RP.

The irrigation plan elements included in the RP are described in the following section, beginning with the Upper Missouri Tributaries planning area and continuing downstream.

Gallatin Unit--Area 1002

This unit would provide supplemental water to 51,139 acres and a full water supply to 7,957 acres located along the Gallatin and East Gallatin Rivers in Gallatin County. The water source would be ground water with nearly 200 wells proposed for installation.

Clarkston Unit--Area 1003

Water from the Missouri River would be pumped and distributed by canal to irrigate 985 new acres of land near the headwaters below Three Forks.

Chestnut Valley Unit-Area 1003

This unit would provide supplemental water service to 1,890 acres and full water service

to 4,470 acres on the east bank of the Missouri River near Cascade. Water would be pumped out of the Missouri River and distributed through canals.

Lower Marias Unit--Areas 1003-1005

This unit would irrigate 127,000 acres of new land in both the Marias and Milk River drainages. Water from Lake Elwell would be distributed to 110,000 acres by the Marias Canal. Lands in the Big Sandy Valley would be supplied with water from a reservoir to be built at Lonesome Lake.

Milk River Supplemental--Area 1005

Four separate alternatives were evaluated for supplying water service to existing and new irrigated lands along the Milk River. Alternative 2, Virgelle-Havre (supplemental water service), was selected for the NED Plan, since its net economic benefits were highest. However, Alternative 3, Telegraph Creek-Beaver Creek, was determined to have less adverse environmental impacts and was selected for the RP. Each involves a pump lift from the Missouri River to the Milk River divide. The Telegraph Creek alternative would entail a pumping plant near the mouth of Telegraph Creek, lifting water into a 60-mile canal which would discharge into the existing Nelson South Feeder Canal. Supplemental water would be provided for 108,140 acres in the Milk River Valley.

Probably the most evident environmental concern is that Alternative 2 would have pumped water from the National Wild and Scenic River portion of the Missouri River, while Alternative 3 would pump water through a part of the Charles M. Russell Wildlife Refuge. A facility of this type probably would not violate the intention of the Wild and Scenic Rivers Act, but concern for the aesthetics of this pristine river area was expressed.

Water for aquatic habitat benefits would not be provided under the Virgelle-Havre alternative, but would occur as a result of Alternative 3. Finally, the energy requirements for the Virgelle-Havre Unit were greater than the Telegraph Creek alternative.

Bonanza Unit--Area 1006

Water would be pumped from the Missouri River to irrigate 800 acres of new land on a bench near Culbertson.

Diamond Ranch Unit-Area 1006

This unit would provide water to 900 acres of new land near Culbertson by pumping water from the Missouri River and distributing it by canal.

Fort Charles Unit--Area 1006

This unit, located near Wolf Point, would provide water to irrigate 3,187 acres of new land. Three pumps would lift water from the Missouri River and distribute it by canal.

Calais Unit--Area 1006

Water from the Missouri River near Brockton would be pumped and delivered by canal to irrigate 6,410 acres of new land.

Farmer Creek Unit--Area 1006

This unit, located just below Fort Peck Dam, consists of 5 pumps lifting water out of the Missouri River to irrigate 888 acres of new land.

Poplar Unit--Area 1006

Four thousand four hundred acres of new land, near the vicinity of Poplar, would be irrigated by pumping water out of the Missouri River.

Development of the Calais, Farmer Creek, Poplar, and Wapiti irrigation units may require removal of significant amounts of riparian vegetation. These plan elements were modified to provide that future feasibility studies include investigation of alternatives that minimize such removal. Detailed coverage of such potential reduction of riparian vegetation and its effects on fish and wildlife resources should be included in all future studies.

Water Conservation

This plan element proposes an acceleration of ongoing conservation measures and the implementation of several additional water conservation measures on existing irrigated lands. These include canal consolidation, canal lining, land leveling, drains, and better irrigation water management. A preliminary analysis showed this program to be economically feasible for all planning areas except the Missouri-Poplar. Implementation of this program could reduce the annual diversions for irrigation in the study area by over one million acre-feet.

Fish and Wildlife

Implementation of Fish and Wildlife Programs on Public Lands

This plan element proposes that programs designed to aid fish and wildlife habitat improvement on public lands be implemented. These programs were authorized by the Sikes Act but no funding has been provided.

Several hundred projects were identified comprising a total of 161,300 acres. The practices included in these projects are seeding and planting, water development, streambank stabilization, removal of stream barriers, and fencing.

Enhancement of Stockwater Ponds

Measures, which enhance wildlife habitat near stockwater ponds, include fencing for livestock exclusion, access ladders and escape ramps, concrete watering basins, and deferred grazing. This plan element proposes that the current installation rate of these measures on public lands be accelerated by 60 percent. Installation of these measures on those ponds which are cost-shared by the federal government would be voluntary on private lands.

Critical Habitat Designation

This plan element recommends that critical habitat for threatened or endangered species should be designated to assure that they are adequately considered in all future federal development and planning activities. The species identified in the study area are: bald eagle, peregrine falcon, gray wolf, grizzly bear, and black-footed ferret.

Riparian Habitat Protection

A proposal assessing the need to identify and acquire extensive areas of riparian habitat was included in the EQ Plan. This was modified to emphasize: 1) the need for an inventory and classification system, 2) the rate and causes of riparian habitat loss, and 3) means or strategies for preservation.

Some of the means suggested for preservation of this habitat include: designation of wild and scenic rivers, adoption of 208 best management practices, and coordination of ongoing local, state, and national programs.

Wildlife Habitat Protection-Areas 1002, 1003 and 1004

Acceleration of wildlife range acquisition was proposed by the EQ Plan. Public reaction to this proposal was predominantly negative. Based on the historic funding availability, the projected outlook for similar funding and the adverse public reaction, the acceleration aspect was dropped. However, several incentive type programs oriented towards improvement of range and rancher-sportsman relationships are being recommended. Implementation of these programs should accelerate the protection of critical wildlife habitat area.

Flood Control

Bozeman Creek Watershed--Area 1002

A bypass diversion would be installed to prevent flooding to lands along Bozeman Creek, including those within the City of Bozeman.

Browning Watershed--Area 1003

One floodwater retarding structure on Willow Creek and two floodwater diversions would prevent flooding for the City of Browning.

Great Falls Local Flood Protection Project--Area 1003

This project would include a levee, drainage structures, and riprap on the left bank of the Sun River in west Great Falls. Runoff from Watson Coulee would be routed by a collector ditch and an interceptor levee. Finally, water would drain into two conduits and pass back into the Sun River.

The Great Falls Local Flood Protection Project is the recommended solution to reoccurring flooding along the Sun and Missouri Rivers. Opposing citizen groups favored either the construction of levees or reservoirs as separate approaches to minimize flood damages. Opposition to the Recommended Plan supporting levee construction resulted from continued citizen interest in the possibility of upstream storage as a means of flood prevention. The construction of upstream dams and reservoirs to reduce flooding was investigated by the Corps of Engineers and found to be economically infeasible. Levees protecting residential areas along the Sun River are justified from a benefit-cost standpoint.

Gibson Flats Watershed--Area 1003

This flood prevention project includes a dike, diversion, and pumping plant to protect areas just south of Great Falls.

Wolf Creek Watershed--Area 1004

Diking along Wolf Creek and an overflow, grassed waterway channel would provide flood prevention for the town of Denton.

Hydropower

Gibson Powerplant--Area 1003

This project would be located on the Sun River just downstream from the existing Gibson Dam and would provide a base load generating capacity of 7.5 megawatts.

Tiber Powerplant--Area 1003

This base load facility would be located near the existing Tiber Dam on the Marias River and would provide five megawatts of electricity.

Broadwater Powerplant--Area 1003

This unit would be a base load facility and produce low head generating capability of ten megawatts at the existing Broadwater Dam on the Missouri River.

Gibson Dam, on the Sun River, is 199 feet high and has a crest length of 960 feet.

Canyon Ferry Powerplant--Area 1003

This unit would be located on the Missouri River at Canyon Ferry Dam and add 90 megawatts to the existing facility. The power generation facility at Canyon Ferry is being considered for peaking power modifications. The major concern is that of fishery impacts. The river below the dam is a popular fishing area and, according to the Montana Department of Fish, Wildlife and Parks, a significant trout spawning area. Fluctuations in stream flows resulting from peaking power water releases could adversely affect this fish habitat, and threaten ice fishing and private docks on Hauser Lake below the dam.

Additionally, the possibility of using "fast-track" legislation, which would make adequate fish and wildlife mitigation measures difficult to obtain is a concern of the Department of Fish, Wildlife and Parks and some citizens. The Water and Power Resources Service indicated such action is improbable because of the time required to complete a feasibility study.

This plan element supports studying the economic and environmental feasibility of changing the power generation of Canyon Ferry from a base load operation to a peaking facility.

Fort Peck Powerplant--Area 1006

This peaking power facility would be located at Fork Peck Dam and would provide additional electrical capacity of 185 megawatts. The proposed power generation modification of Fort Peck Dam would include a downstream regulating reservoir and result in river modifications in an eight mile reach below Fort Peck Dam.

Phase I studies, as proposed by the Corps, would include environmental studies to address impacts on fisheries, water temperature, wildlife and recreation. State and Federal interests want some guarantee of adequate fish and wildlife mitigation prior to construction. A controversy arose when the question was raised as to who would determine what constitutes adequate mitigation measures.

This report recommends that Phase I studies be conducted to determine local support and obtain needed planning and environmental study results including satisfactory resolution of any conflicts as a part of this effort. An adequate fish and wildlife mitigation plan should be developed as part of the study in a joint effort with the Montana Department of Fish, Wildlife and Parks, U.S. Fish and Wildlife Service, and Environmental Protection Agency.

Land Conservation

Accelerate Land and Water Conservation Measures

This element recommends the implementation of a 25 percent increase in present land treatment rates for the application of soil and water conservation practices. This would be accomplished through the ASCS and SCS on private lands and BLM and FS on public lands.

Farm pond in North-Central Montana.

Saline Seep Funding

The DNRC is encouraged to seek additional funding sources to expand the saline seep prevention, abatement, and research program similar to that now underway in the Triangle Conservation Districts Area.

The potential appropriation sources include: 1) the state legislature through the Renewable Resource Development Program, and/ or 2) the Old West Regional Commission through the conservation districts.

Land Use Planning

Flood Plain Management Program

This plan element encourages the Montana Legislature to increase funding for DNRC's Floodplain Management Program. This program provides for the management and regulation of flood prone lands in an effort to prevent or alleviate future flood losses.

Water Quality

Implement the 208 Water Quality Management Plans

This element endorses the nonregulatory program for alleviating nonpoint source pollution and recommends that the conservation districts, as lead agency, implement the best management practices as recommended in the Statewide and Blue Ribbon of the Big Sky water quality management plans.

Muddy Creek

This element recommends that the Muddy Creek Task Force develop a solution to reduce the erosion and sediment problem associated with Muddy Creek. Some of the solutions being considered are: 1) on-farm management, 2) supply canal relief, 3) Muddy Creek channel stabilization and rehabilitation, 4) interceptor canal, 5) Greenfields Irrigation District Operation and Maintenance, 6) information and education program, and 7) funding strategy.

Multi-purpose

Boulder River Watershed--Area 1002

From a 15,000 acre-foot reservoir, water would be delivered to provide supplemental irrigation for 7,300 acres and full service for 3,400 acres of new land along Boulder River in Jefferson County. Also included in this project are recreation and stream fishery enhancement.

Fort Benton Unit

This project would include a powerplant, dam, afterbay dam, and facilities to irrigate 8,700 acres along the Missouri River area near Fort Benton. The hydropower capacity of the powerplant would be 360 megawatts.

The construction of the dam would create a reservoir backing some 30 miles up the Missouri River and inundating over 20,000 acres. The construction of an afterbay dam below the damsite shown in the NED Plan would fall within the section of the Missouri River designated as wild and scenic. Planning for this proposal has identified several development alternatives.

Concerns expressed by several interests include: 1) the historical significance of this reach of the river, 2) how fluctuating flows would affect the wild and scenic portion, and 3) the impact on the stretch from Morony Dam to Fort Benton, an important paddlefish and sauger spawning area.

The Recommended Plan supports the continuation of the reformulation study being conducted by the Water and Power Resources Service. One aspect of this study is to minimize possible impacts to the wild and scenic river area.

Display of Modified Plan Elements

To avoid duplication, four account displays for only those elements which were modified in moving from the NED and EQ Plans to the Recommended Plan are shown in table 36. Display tables for all other plan elements included in the RP are shown in Chapter IV as previously referenced in table 35.

Table 36
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
RECOMMENDED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
AGRICULTURE (Irrigation)				
Milk (1005) Milk River, Supplemental Service, Telegraph-Beaver Creeks, Alternative No. 3, Phillips and Valley Counties. Irrigable Area: Supplemental 108,140 acres This plan would provide supplemental water service to the Milk River Valley. The irrigable land lies in an area known as Sun Prairie. A pumping plant located near the mouth of Telegraph Creek where it enters Fort Peck Reservoir would lift water from the reservoir to the existing Nelson South Feeder Canal which terminates at Nelson Reservoir. This water would be conveyed by a 80-mile canal. After regulation, the water would be released down the river to supply supplemental water to existing irrigation developments.	Direct Benefits (Annual) Irrigation $4,326,000 Adverse Effects (Annual) Investment $2,218,000 O, M&R 118,000 TOTAL $2,336,000 Net Beneficial Effects $1,990,000 Total Investment Cost $32,213,000	Rangeland in much of the area has been overgrazed and as a result has a low vegetative cover. Increased flows in the Milk River may improve water quality in some sections of the river. The air quality could be improved in areas where the vegetative cover is sparse at the present time. In these areas the irrigated crops would provide more cover. The powerline and the pumping plant would be a visual intrusion. Vegetation would be removed when a distribution system is constructed. Increasing flows in the Milk River may increase bank erosion. Increases in sediment could impact the fisheries in the Milk River. Areas of paleontological significance could be encountered. Additional water to Bowdoin National Wildlife Refuge would benefit in flushing and maintaining marshes in a fresh condition and prevent its continued decline in value as a waterfowl migration area. Waterfowl marshes could be developed at UL Bend National Wildlife Refuge providing benefits to waterfowl production. The irrigation canal could impede migration of area elk herds. Additional agricultural development could result in net loss of wildlife habitat, including riparian vegetation.	Direct Benefits (Annual) Irrigation $4,326,000 Indirect Benefits (Annual) Irrigation $2,596,000 Employment $1,036,000 Total Annual Benefits $7,958,000 Adverse Effects (Annual) Investment $554,000 O, M&R 118,000 Net Beneficial Effects $7,286,000	Construction would be completed within 4 years. An estimated 450 man-years would be required for project construction. Approximately 225 people would be employed on the project during the peak construction period, and an additional 85 indirect job opportunities would be created. The total population increase is estimated at 465. No additional farms would be created as a result of the project. Incomes of the area would increase as a result of construction employee earnings and expenditures. Malta is the largest community in the area. A population influx of approximately 465 people could put a strain on local community facilities and services. The population is estimated to increase by 144 during the peak construction period. O&M personnel estimated to total 3.

FLOOD CONTROL				
Upper Missouri Tributaries (1002) Bozeman Creek Watershed, Gallatin County Flood prevention along Bozeman Creek and the adjacent area including the city of Bozeman Improvements would include a bypass diversion, diking, culverts and channel work	Investment Cost $251,000 Annual Cost $18,400 Annual Benefits $18,900	No significant adverse impacts. Channel work and culvert construction would prevent water from flowing over industrial wastes, preventing these wastes from being flushed into river system.	Not available.	Provide four man-years of temporary semi-skilled construction and service employment Enhancement of quality of life, health and safety for 200 residents Protect 80 acres of urban land Provide a 100-year level of protection to local businesses, homes and housing Highway flooding would be further reduced
FISH AND WILDLIFE				
Study Area Preservation and enhancement of riparian habitat. An interagency task force led by DFWP should investigate the status of riparian habitat and identify measures to protect and enhance it. This study should include the following items: 1) Document the importance of riparian habitat. 2) Inventory riparian habitat. 3) Determine rate and causes of riparian habitat loss. 4) Determine implementable strategies for preservation: a) coordination of ongoing programs by local, state and federal agencies, including recognition of Executive Orders #11988 and #11990; b) designation of suitable rivers under National Wild and Scenic Rivers; c) adoption of best management practices including riparian vegetation protection for 208 Water Quality plans; d) implementation of the Subdivision and Platting Act of 1973; e) new legislation to provide authority for easements and fee title acquisition, and f) recognition of green belts and their importance as a phase of urban flood plain planning	Hunting benefits (not determined)	Habitat and associated fish and wildlife species preserved. Improved water quality. Streambank stability, reduced soil erosion, increased natural beauty. Benefits from streambank protection, water quality improvement, soil stability, and wildlife.	Small local economic gain, increase in natural areas and amenities, local recreation Increase in land values near preserved areas. Improved water quality and reduced treatment costs. Less land available for agricultural, industrial, and residential development in riparian zone	Create a public awareness of the importance of riparian habitat

Table 36 (Continued)
DISPLAY OF BENEFICIAL AND ADVERSE EFFECTS
RECOMMENDED PLAN

PLAN ELEMENT	ACCOUNT			
	NATIONAL ECONOMIC DEVELOPMENT[a]	ENVIRONMENTAL QUALITY	REGIONAL DEVELOPMENT	SOCIAL WELL-BEING
FISH AND WILDLIFE				
Study Area The DFWP, in cooperation with the FWS, FS, BLM and local counties, should accelerate wildlife habitat protection through a multi-program approach. 1) Identify critical wildlife areas. 2) Continue the DFWP's wildlife acquisition program from willing sellers.[a] 3) Encourage implementation of the following strategies: a) land trades between public agencies (FS, FWS, and BLM) and private land holders b) provide incentives to land owners --encourage proper land management practices such as rest-rotation grazing, --tax relief or direct payment for protection of critical habitat --conservation easements --grazing leases on state-owned wildlife areas --encourage a new policy which would allow the transfer of multiple-use areas to that of a single use and vice versa on all public lands. This would permit existing single use non-critical areas to be used through a grazing lease program. This would also permit existing multiple-use critical areas to be transferred to single use for wildlife. c) require zoning and transportation planning to recognize wildlife areas for protection d) discourage conversion of rangeland to cropland e) implement educational programs to demonstrate the value of wildlife, and f) encourage long-term land use adjustments	Not Available.	Improved wildlife habitat. Improved water quality. Decrease in wildlife damage to adjacent farm lands.	Improved grazing practices. Increased recreation benefits. Increase in natural areas. Loss of agricultural production. Less land available for agricultural, industrial and residential development.	Improved opportunities for viewing and hunting. Decrease in landowner-sportsman conflicts. Changes in land ownership.

[a]See discussion of FWO on page Estimated costs of acquisition for the ongoing FWO through year 2000 are $75,000,000.

MULTI-PURPOSE				
Missouri-Marias (1003)				
Fort Benton Unit,[a] Chouteau County Hydropower Capacity 360 megawatts Fort Benton Dam 204 feet high; 4,550 feet long Afterbay Dam 65 feet high; 2,115 feet long Irrigable Area: New 8,700 acres This project includes a dam and power-plant on the Missouri River about 1 mile upstream from Fort Benton, Montana, an afterbay dam 11 miles downstream, and facilities to irrigate 8,700 acres on a bench to the north of the reservoir and extending eastward to the town of Loma, Montana Fort Benton Dam would be a rolled earthfill structure containing 15,000,000 cubic yards of material The spillway, located in the right abutment, would be a gate-controlled, rectangular, concrete chute and have a maximum discharge of 245,000 cfs Reservoir releases to a turbine pumping plant for irrigation pumping would be made through a gate-controlled conduit, located in the right abutment Power penstocks through the right side of the dam would lead to 4 turbine generators of 90,000-kw capacity each. (Annual generation would be 760 gwh). Surge tanks would be required The reservoir would extend 30 miles upstream to the tailwater of existing Morony Dam, have a surface area of 10,200 acres and contain 880,000 acre-feet Fort Benton Afterbay Dam would be constructed 11 miles downstream from the main dam. It would also be a rolled earthfill structure containing a total of 555,000 cubic yards. The spillway, located in the left side of the dam would be a combination gate-controlled sluiceway and overflow weir having a maximum discharge of 245,000 cfs	Direct Benefits (Annual) Irrigation $1,141,000 Power 39,016,000 Fish/Wildlife 354,000 Recreation 1,525,000 TOTAL $42,036,000 Adverse Effects (Annual) Investment $32,375,000 O, M&P. 1,823,000 TOTAL $34,198,000 Net Beneficial Effects $7,838,000 Total Investment Cost $470,296,000	Operation of Fort Benton Reservoir and the afterbay would result in an improved flow regime below the afterbay dam. Fort Benton Reservoir may create a more favorable habitat for warm water fish than does the river at present. Increased numbers of these fishes may move from the reservoir up Belt and Highwood Creeks and provide warm-water fishing The reservoir would inundate a number of islands in the river covered with willows, cottonwoods and marsh grass, which serve as resting and nesting sites for migratory waterfowl. Many of the islands and the bottomlands in and adjacent to the proposed afterbay impoundment, also afford good deer cover and good hunting. The impoundment may cause the introduction of predacious fish, such as northern pike, into Belt and Highwood Creeks. Numerous songbirds, raptors, and other nongame species, including large numbers of great blue herons are found along the river in the project area and would lose habitat. The afterbay dam would be located in the upper end of the portion of the Missouri River that is designated as a Wild and Scenic River. The area impounded by the afterbay dam would be subject to large fluctuations. The Fort Benton Reservoir would inundate 30 miles of the Missouri River Canyon almost to the tailwaters of Morony Dam.	Direct Benefits (Annual) Irrigation $1,141,000 Power 9,754,000 Fish/Wildlife 177,000 Recreation 762,000 Indirect Benefits (Annual) Irrigation $685,000 Employment $14,380,000 Total Annual Benefits $26,899,000 Adverse Effects (Annual) Investment $8,094,000 O, M&R 514,000 Total Annual Cost $8,608,000 Net Beneficial Effects $18,291,000	The project is estimated to take 7 years to complete Total man-years required for construction are estimated as 7,000 The peak year on-site employment is estimated as 3,500 and indirect employment is 1,300. The total population increase during the peak construction period is estimated as 7,200 Twenty-seven farms of 320-acre equivalency would be created The on-farm population would increase by 81 Operation and maintenance would require 55 Great Falls and Fort Benton are located in the project area A strain could be placed on the community facilities and services The results could be higher rents for those on fixed incomes and overcrowding which could adversely affect the mental and physical health of some segments of the population Loss of 8,000 acres of prime farm land in the reservoir area

[a]The information displayed in this table is for illustrative purposes. A Reformulation Study of this unit is recommended and is presently underway

Plan Recommendations

Those recommendations which are included in the Recommended Plan are shown in table 37 and discussed in this section.

Agriculture

Lower Birch Creek--Area 1003

The Soil Conservation Service should determine the feasibility, local interest, and support for a small watershed irrigation rehabilitation project on Lower Birch Creek in Pondera County.

Newlan Creek--Area 1003

Questions surrounding the diversion from Sheep Creek to Newlan Creek need to be satisfactorily resolved. If fulfillment of project purposes appears to be economical and desirable, the Meagher County Newlan Creek Water District, Meagher County Soil and Water Conservation District, and Meagher County Commissioners should investigate possible funding sources to allow completion of the Newlan Creek Watershed Project. Potential sources are the small projects loan program of the Water and Power Resources Service and the Resource Indemnity Trust Fund through the Montana Legislature.

Flood Control

Ten Mile Creek--Area 1003

The Soil Conservation Service should determine the feasibility, local interest, and support for Ten Mile Creek Watershed project in Lewis and Clark County and proceed accordingly on watershed planning studies.

Table 37
PLAN RECOMMENDATIONS

Plan Recommendation	Purpose	Reference Page[a]
Agriculture		
Lower Birch Creek Watershed	Irrigation	112
Newlan Creek Watershed	Construction funding	112
Flood Control		
Ten Mile Creek Watershed	Flood prevention	112
Fish and Wildlife		
Provide instream flows for fish and wildlife	Enhance fish and wildlife resources	113
Hydropower		
Comprehensive energy-environmental study of Missouri River	Address environmental, recreational, power, flood, irrigation and other concerns	113
Land Use Planning		
Amend legislation	Completion of necessary plans to avoid misuse	113
Outdoor Recreation		
Enact natural landmark legislation	Protect natural landmarks	114
Amend Montana Antiquities Act	Protect historic sites	114
Coordinate Management of public areas[b]	Provide access and encourage use of underused areas	114
Study selected stream segments	Protect unique river systems for natural characteristics	114
Streambank Erosion Control		
Revegetation	Develop techniques to reduce and repair streambank erosion	114
Water Quality		
Madison River thermal	Improve Madison River water quality (temperature)	115
Increase funding to Abandoned Mine Land Reclamation Program	Control mine acid wastes	115
Multi-Purpose		
Willow Creek Watershed	Irrigation, flood prevention	115

[a]Page where a more detailed discussion can be found.
[b]Cost of access program, $46,200,000.

Fish and Wildlife

Provide Instream Flows

The first step in the provision of instream flows should be the utilization of the existing water reservation process. This process provides a means of reserving instream flows for beneficial use, which includes fish and wildlife, recreation, and water quality.

The reservation of a certain volume of water for instream use, especially in streams that are not over-appropriated, is one means of assuring adequate habitat for fish populations. There is presently no legal means of insuring a permanent stream flow volume not subject to prior use rights. Acquisition of a water use permit for non-consumptive instream use does not guarantee flow volumes because under present law, a permit holder must "...divert, impound, or withdraw..."

The Department of Fish, Wildlife and Parks, in cooperation with the Department of Natural Resources and Conservation, should study the impact of enacting legislation that would authorize, where mutually agreeable, the transfer and change in use of water rights from agricultural, industrial, and municipal purposes to maintenance of instream flows. Such legislation, while permitting a transfer to instream use, should not allow new stream permits for instream flows to be issued on unappropriated water. Any new legislation should also not allow condemnation of a water right for instream flow purposes.

The EQ Plan advocated a change in state law to allow existing water rights to be voluntarily transferred in order to maintain instream flows. The RP emphasizes the need to study the impacts of such a change in legislation before proceeding.

Missouri River flows through the study area

Hydropower

Missouri River Energy-Environmental Study

Possible changes in hydropower generation on the Missouri River between Helena and Fort Benton may cause environmental degradation. The cumulative effects of such generation should be evaluated by power development and environmental interests. Therefore, the Congress should fund the Water and Power Resources Service as lead agency and other agencies as cooperators in a comprehensive energy-environmental study of the Missouri River from Canyon Ferry to Fort Benton.

Such study should address environmental and recreational values as well as electric power production, flood control, irrigation and municipal and industrial water supply. The study should be completed by 1990 and begin with an environmental and recreational analysis and a power needs inventory and marketing assessment. Key cooperating agencies would include the Heritage Conservation and Recreation Service, Bureau of Land Management, Corps of Engineers, Fish and Wildlife Service, Environmental Protection Agency, Federal Energy Regulatory Commission, and the Montana Departments of Natural Resources and Conservation and Fish, Wildlife and Parks.

Land Use Planning

Amend State Legislation

The authority for regulation of most types of urban development is vested with units of local government under Montana law. Subdivision, zoning, flood plain, and sediment control regulations and development and road standards are among the means available to local officials for influencing the location and type of land development. Several authorized local regulations require adoption of a comprehensive plan as a prerequisite. All of them are more effective if enforced as part of an overall community planning effort.

The EQ Plan recommended adoption of county land use planning and mandatory county zoning. Because existing regulations do not provide the authority needed at the local level, amendments in legislation were recommended.

To help assure that county growth is consistent with the community's comprehensive

plan, the Montana Legislature should: 1) amend the Subdivision and Platting Act in order to stop abuse of the law's exemptions and provide local governments with the authority they need to direct development of their communities, 2) amend the County Zoning Enabling Act to eliminate the provision which allows a minority of county landowners to block adoption of county zoning, and 3) continue the allocation of coal severance tax revenues to the county land planning fund as a means of supporting local community planning efforts.

Waterfall in Glacier National Park.

Outdoor Recreation

Enact Natural Landmark Legislation

The Montana Department of Fish, Wildlife and Parks, in cooperation with the U.S. Heritage Conservation and Recreation Service, should draft legislation similar to that of the National Historic Preservation Act (P.L. 89-6651) and related executive orders to regulate federal, state, and local actions which will provide for the protection of all natural landmarks of state or national significance.

Amend Montana Antiquities Act

The Montana Legislature should amend the Antiquities Act of 1979 and allow for the implementation of programs and policies to apply regulations similar to the National Historic Preservation Act and related executive orders for state and local actions affecting sites on or eligible for the National Register of Historic Places.

Coordinate Management of Public Recreation Areas

State and Federal agencies responsible for managing public recreation areas should increase their efforts of coordination to provide for: better access, limiting use of overused areas, and encouraging use of underused areas.

Study Selected Stream Segments

Several study area streams appear to have the potential for designation as wild, scenic, and recreational as a part of the national system of pristine river identification and designation. The process consists of three sequential steps of inventory, study authorization, and designation. The Heritage Conservation and Recreation Service failed to gain the State's approval to conduct the inventory phase. The EQ Plan included a plan element proposing a study be initiated to select streams for the national system. However, state and local interests prefer to minimize national attention to such areas and provide for appropriate state level recognition of these unique areas.

The State of Montana, in cooperation with local citizens' groups and appropriate federal agencies should conduct studies of rivers and recommend appropriate methods of protection. The following rivers should receive initial consideration for study: Big Hole (1002), Gallatin (1002), Jefferson (1002), Madison (1002), Smith (1003), and Missouri, below Fork Peck Dam to North Dakota border (1006).

Study items to be considered for the above mentioned rivers include: 1) conservation easements, 2) landowner agreements, 3) county zoning, 4) tax incentives for undeveloped riparian areas, 5) development of grazing management plans aimed toward riparian habitat preservation, 6) investigation of various sources of funding to accomplish several of the above mentioned items, and 7) a river and riparian area informational program.

If desired local protection is not achieved by 1990, additional study for potential inclusion in the National Wild and Scenic Rivers System should be considered.

Streambank Erosion Control

Streambank Revegetation

Evaluation of revegetation techniques used for controlling streambank erosion should be continued and additional pilot programs similar to that developed in Teton County

should be established and monitored. The Soil Conservation Service, Corps of Engineers, and Forest Service should analyze revegetation as an alternative to structural measures for site specific streambank erosion control.

The EQ Plan identified streambank revegetation as a viable means of reducing streambank erosion on selected stream segments. During development of the RP, it was generally agreed that this proposal would have limited application and the primary thrust should be additional research and demonstration of the validity of this method on various-sized streams under varying streamflows.

Water Quality

Madison River Thermal--Area 1002

One of the problems identified in the study process was thermal pollution of the Madison River downstream from Ennis Lake. The EQ Plan failed to identify a specific solution. The RP suggests sources of funding for the Madison Thermal Pollution Steering Committee. This committee, under the leadership of the Blue Ribbons of the Big Sky APO, should identify the best option for eliminating the thermal pollution problem below Ennis Lake.

Funding to accomplish the study and implementation of the identified solution should be provided by the Montana Legislature (through the RRDF) and the Environmental Protection Agency (through the Lake Restoration Program and other appropriate funding sources).

Abandoned Mine Land Reclamation Program

The Montana Legislature should increase funding to the Department of State Lands so the Abandoned Mine Land Reclamation Program can be expanded to control mine acid wastes. The Department of State Lands is encouraged to pursue potential hard rock reclamation projects for mining areas in the headwaters of Prickly Pear Creek east of Jefferson City, Ten Mile Creek west of Helena, and other areas. In addition, an inventory of potential mining problems in the Boulder River drainage should be completed by the Department.

Multi-purpose

Willow Creek-Area 1005

The Soil Conservation Service should determine the feasibility, local interest and support for the Willow Creek small watershed project in Valley County. This project would include irrigation, flood control, and recreation.

Impact of the Plans

This section summarizes and compares the alternative NED, EQ, and Recommended Plans in terms of each plan's response in meeting needs and opportunities of the Upper Missouri study area. Wherever practicable these effects are quantified, but for some components or functions only qualitative observations are made. All observations are useful in comparing anticipated results of the alternative plans, recognizing that the evaluations are mostly preliminary. The potential components will require detailed study and recommendation before many of them can be implemented.

Analyses were made for both near-term and mid-term. However, only the year 2000 conditions are shown in the following impact analyses. These results should be used in determining which resource related activities and developments should move forward to implementation, following detailed study.

Assessment of Plans' Capability to Meet Needs

Some plan components will qualify for federal assistance while others must be implemented by state and local interests. While not considered a formal part of the Recommended Plan, the FWO contributions are important in understanding the nature and responses to total needs, and are displayed briefly in table 38. Although the responses to identified needs were of primary concern, opportunities were also identified where important to a given function or area.

Table 38 shows the comparison of alternative plan capabilities for the study area by component and function. Needs are projected to year 2000, met in part by the FWO contribution. In some instances, these without plan contributions suffice, but in most instances the residual need or opportunity was addressed by the alternative plans, with the results displayed. Similar information for the five planning areas appears in the Plan Formulation Technical Paper. For several functions, the needs and responses were not available or could not be distributed to the planning areas, and are shown only for the study area. A standard set of footnotes, used to supplement the items shown in tables 38 and 39 appears after table 38.

Table 38
ALTERNATE PLAN CAPABILITY — STUDY AREA

Function	Unit	Cumulative—Year 2000		Remaining Need Or Opportunity	Recommended Plan			Alternative Plan Responses			
		Need Or Opportunity	Without Plan Condition		From NED	From EQ	Remaining Need	NED		EQ	
								Provides	Remaining	Provides	Remaining
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Agriculture (Irrigation)[a]											
a Nonirrigated Crop Area	Acres	6,358,000	6,358,000	0	0	0	0	0	0	0	0
b Nonirrigated Crop Production	% Crn't Norm	132-195	123-151	9-44	0	0	9-44	(314,790)	9-44	0	9-44
c Irrigated Crop Area	Acres	1,521,000	1,096,000	425,000	(314,790) 172,876[b]	0	157,687	181,476	149,087	0	425,000
d Irrigated Crop Production	% Crn't Norm	132-195	125-148	7-47	4-30	0	3-17	4-30	3-17	0	7-47
e Overall Irrigation Water Efficiency	Percent	35	23.8	11.2	7.4	0	3.8	7.4	3.8	0	11.2
f Livestock (Beef, Pork, Lamb, Mutton)	M Lbs.	1,020,000	767,000	253,000	167,565	0	85,435	164,380	88,620	0	253,000
g Timber Production	MM Bd. Ft.	972	156	816	NA	0	NA	NA	NA	0	NA
Municipal and Rural Domestic Water Supply	Ac. Ft.	80	80	0	0	0	0	0	0	0	0
Livestock Water Supply (Depletion)	Ac. Ft.	27	27	0	0	0	0	0	0	0	0
Nonenergy Industrial Water Supply (Depletion)	Ac. Ft.	7	7	0	0	0	0	0	0	0	0
Land and Water Conservation[a]											
a Area Requiring Treatment	M Acres	20,648	9,540	11,108	22	1,520	9,566	22	11,086	1,520	9,588
b Capitalized Cost	M Dollars	692,215	248,726	443,489	5,509	30,101	407,879	5,509	437,980	30,101	413,388
c. Saline Seep Alleviation[c]	Acres	108,775	Less than increase	108,775	0	NA	NA	0	NA	NA	NA
d Saline Seep Alleviation	M Dollars	6,241[d]	241	6,000[e]	0	6,000	0	0	6,000	6,000	0
Flood Control											
a Area Affected	M Acres	1,002	0	1,002	2.7	0	999.3	2.7	999.3	0	1,002
b Average Annual Damage	M Dollars	10,660[f]	1,697	8,963	2,000	50[g]	6,913	1,993	6,970	50[g]	8,913
c Flood Plain Management (State's Flood Plain Surveys)	M Dollars/yr.	80[h]	40	40	0	40	0	0	40	40	0
Streambank Erosion											
a Affected Length Stream	Bank Miles	2,390	0	2,390	0	60[g]	2,330	0	2,390	60[g]	2,330
b Average Annual Damages	M Dollars	687	0	687	0	NA	NA	0	NA	NA	NA
Fish and Wildlife											
a Stream Fishing—Lost to Reservoirs	Miles	NA	NA	NA	90.3	0	NA	90.3	NA	0	NA
b Stream Fishing—Improved by Regulation	Miles	NA	0	NA	224	0	NA	224	NA	0	224
c Lake Fishing—Flatwater Area	Acres	See "Fishing Days"			5,165	0	0	5,165	0	0	5,165
d Establish Wildlife Areas	M Dollars	135,000[d]	75,000	60,000	0	0	0	0	60,000	60,000	0
e Improve Wildlife Habitat—Public Land	M Acres	161	0	161	0	161	0	0	-161	161	0
f Preserve/Entrance Wildlife Habitat	M Dollars	1,460,820[d]	75,000	1,385,820	0	0	1,385,820	0	0	0	0

g Fuller Use—Public Land Area	M Acres	15,827	NA	15,827	See "Outdoor Recreation" below						
h Reservoirs Ponds—Net Wildlife Area—Land/Water	Acres	NA	NA	NA	4,409/7,600	574/576[i]	NA	4,409/7,600	NA	574/576[i]	NA
i Stockwater Pond Wildlife Measures	Ponds/M $	1,363/478	213/75	1,150/403	0	1150/403	0	0	1,150/403	1,150/403	0
j Fish/Wildlife Enhancement—Public Lands	M Dollars	7,839	0	7,839	0	7,839	0	0	7,839	7,839	0
k. Fishing—Cold and Warm Water	M Days	1,714	1,371	343	113	15[g]	215	113	230	15[g]	328
l. Hunting	M Days	1,423	1,139	284	NA	NA	NA	NA	NA	NA	NA
m Hunting	M Acres	7,500	-107	7,607	NA	NA	NA	NA	NA	NA	NA
Outdoor Recreation											
a Public Recreation Areas — Carrying Capacity, Reasonable Use. Winter/General Access*	M Dollars	91,146[d]	44,946	46,200	0	46,200	0	0	46,200	46,200	0
b Recreation Units Needed by 2000	No./and M Recreation Days										
1)Hunting (Sections—Public/Private Lands)		1,418.9/340	As at left	*See stated need for public recreation Areas assessment, funding and development	0	See Column (5)		0		See Column (5)	
2)Boating(Launching Facility)	"	17/51	"		0			0			
3)Developed Camping (Facilities)	No./and M Recreation Days	1,842/449	As at left		0	"		0		"	
4)Day Use (Picknicking)	"	447/116	"		0	"		0		"	
5)Nonurban Swimming	"	13/43	"		0	"		0		"	
6)Skiing (Downhill Cross Country)	"	13/228	"	"	0	"		0		"	
7)Backpacking—Trails (Facilities)	"	10/175	"	"	0	"		0		"	
8)Snowshoeing (Facilities)	"	33/560	"	"	0	"		0		"	
c Wild, Scenic, Recreation Rivers—Potential	Studies/Miles	6/696	0	6/696	0	6/696[k]	0	0	6/696	6/630	66
d Management Efforts —Multi-agency	Program	XX	X	X	X	X	0	X	0	X	0
e Reservoirs—Recreation Area —Land/Water	Acres	NA	NA	NA	2,352/7,600	0	NA	2,352/7,600	NA	0	NA
Water Quality and Instream Flows											
a Water Quality—Point Sources	W Q Standards	Compliance	Compliance	Compliance with "Water Quality Standards" expected by 1983							
b Water Quality—Nonpoint Sources	"	"	Underway	Assume continued progress in implementing "208" effective management requirements							
c Instream Flows—General	State Program	Formulate	Pending	Formulate technical design. Seek legislation, water reservations, and administration program							
d Instream Flows—General	Specifics	Implement		Implement through exchanges and reservations, and adequate administration							
e Salt Diversion/Pickup, Water Conservation Progress	M Tons	678	169	509	339	0	170	339	170	0	509
Hydroelectric Power[l]											
a Electric Generating Capacity	Megawatts	893.5	(235)	893.5	893.5	0	0	693 5	200	0	893 5
b Electric Generation	Gigawatt Hrs/Yr	2,263	(1,398)	2,263	2,263	0	0	2,263	0	0	2,263

*Implementation of the above programs and continued funding of the ongoing "Without" program, taken together, should satisfy the requirement to assess and provide specific public and facility needs Tentatively, the number of recreation facilities needed by year 2000 and expected recreation day responses are as shown

KEY TO NOTATIONS
(Tables 38 and 39)

NA—Not available.
UMSA—See Upper Missouri Study Area.
[a] See text for explanation of applicable procedures.
[b] Dropped Cameron Bench Unit irrigation of 17,300 acres in NED and added Fort Benton Unit of 8,700 acres.
[c] Need or opportunity represents 1974 Saline Seep affected acreage—current rate of alleviation is less than rate of increase in acreage of lands affected.
[d] Sum of columns (4) and (5).
[e] Includes Montana's $6 million "Saline Seep" program not distributed to planning areas—$285,000; Annual Benefits, NA.
[f] Without Plan damages of $8,963,000 increased by 16 percent, the effect of the accelerated flood plain regulation (W/O Plan).
[g] Muddy Creek Unit.
[h] Reflects Montana's $471,000 Flood Plain Management Program not distributed to planning areas—Annual Cost, $40,000; Annual Benefits, NA. Excludes any estimate of annual benefits for one or more components—not determined.
[j] Assumed approximately 50/50 percent of aggregate available acreage to land/water.
[k] EQ Plan included only 24 miles of Madison River; RP included entire length of Madison—90 miles.
[l] Present installed capacity of Canyon Ferry and Fort Peck of 235 mw, with average annual generation of 1,398 gigawatt hours for system production, to be increased to 510 mw and converted to "peaking" and produce 1,427 gigawatt hours/yr. Five other plants to be added for basic production. Recommended Plan adds 200 mw to NED Fort Benton's 460 mw potential.
[m] Assignable on specific project potentials—both for full and supplemental irrigation supplies.
[n] Assignable for supplemental irrigation; improvement of facilities and management, etc. under the Water Conservation Program less duplication in project potentials of
[p] Excludes any estimate of annual benefits for one or more components not determined, though total cost and annual cost are included.
[q] Represents cost allocation to "Environment" of potential Muddy Creek streambank erosion control components; other of its costs are allocated to irrigation, flood control, recreation and fish/wildlife.
[r] Includes $1,325,820,000 to "Preserve/Enhance Riparian Habitat" not distributed to planning areas—Annual Cost, $112,000,000; Annual Benefits, NA. See text for disposition in Recommended Plan.
[s] Includes $46,200,000 for "Limiting use of public recreation areas to carrying capacity, use of underutilized areas, areas/facilities should be open to winter use, and access to public recreation lands through public/private lands should be accelerated,"(491 miles estimated as being involved); This estimated Investment Cost and Annual Cost of $3,920,000 not distributed to planning areas; Annual Benefits, NA.
[t] Represents allocation to municipal and industrial water use on potential Lower Marias Unit.
[u] Hunting days not evaluated though some components would have beneficial or adverse effects.
[v] Fishing and recreation days were evaluated for only a portion of the components having flatwater; detriments to fishing streams were not evaluated.
[w] Drop Cameron Unit of NED Plan—17,300 acres.
[y] Add Fort Benton Unit irrigation of 8,700 acres.
[z] Includes 107,030 acres in Milk Planning Area; water to be diverted from Elwell Reservoir on Marias.

Under the agriculture (irrigation) entries, the need or opportunity (Column 3) figures represent the residual of project requirements and the projected capability to fulfill them in the without plan condition. For the study area the nonirrigated acreage would expand from 5,491,400 acres, at present to about 6,358,000 acres. This, along with improved yields per acre, would permit nonirrigated lands to produce from 123-151 percent of the current normal production for several crops under without plan conditions. Where the guideline

projections of OBERS indicate this required level to be 132-195 percent of current normal, this shows a shortfall of 9-44 percent in crop production. For the irrigated crop area, this was estimated to expand from 964,000 acres at present to 1,096,000 under the without plan condition and have the capability to produce 125-148 percent of current normal crop production in the year 2000. This leaves a shortfall of 7-47 percent for the level of individual crops presented. Since the anticipated expanded capabilities of the non-irrigated lands had already been taken into account, it was concluded that the shortfall should be accommodated as practicable from additional irrigation potential. Considering the projected unit yields for individual crops and shortfall by each of them, this was translated into the needed irrigated acreages which aggregated 425,000 acres for the areas as a whole.

This 425,000 irrigated-acre opportunity for the study area was distributed among the five planning areas based on the ratio of their respective equivalent full irrigation potential in the Recommended Plan to that of the study area. Here, the "equivalent full irrigated acreage" is the sum of the full irrigated area and three-tenths of the supplemental service acreage from the Recommended Plan.

Irrigated Crop Production is expressed: 1) in terms of the range in percent of computed current normal production for several crops--e.g., 132-195 percent; 2) as that range accumulated from the current normal (100 percent) to reflect projected production under the without plan condition; and (3) as the residual range reflecting one measure of need for comparison with the alternative plan responses. For the study area this reflects 267,313/425,000 × 7-47 percent, or 4-30 percent, which indicates about 63 percent of the suggested opportunity.

Meat production as shown reflects a shortfall of 253,000,000 pounds based on the OBERS projected requirement for beef, pork, and mutton in year 2000 (1,020,000,000 pounds) less the computed area capability of beef production (767,000,000 pounds). This shortfall in meat production can be overcome only by an increase in feed production and thus in the ability to produce more livestock. The shortfall, in terms of meat production, was distributed to the individual planning areas relative to their respective equivalent irrigated acreage potential. Using the projected feed crop yields and livestock ratio for each planning area, a determination was made of its unit live-weight meat production capability. This unit capability in pounds of live weight per equivalent irrigated acre, by planning acre, was: Upper Missouri 682; Missouri-Marias 664; Missouri-Musselshell 499; Milk 613; and Missouri-Poplar 530--an average of 653 pounds for the study area. On this basis the study area showed the capability to produce about 66 percent of the shortfall in live-weight meat.

In this determination it was not practicable to take into account some added forage capability of nonirrigated range and pasture lands under the NED assumption of a 25 percent acceleration in land and water conservation measures--this could reduce the shortfall somewhat. However, neither was it practicable to consider the opposite effect of loss to range and pasture acres shifted to other uses under the Recommended Plan, and how much feed capability would be lost.

Acreages and costs for a 25 percent acceleration of land and water conservation measures have been distributed to the EQ Plan, except for irrigation measures. The amount in terms of both acres and costs are shown under the EQ account in table 38. The costs for irrigation measures are shown in the NED account under agriculture (irrigation), being a part of the Water Conservation Program and included there along with project-type irrigation components.

Most other needs and responses in table 38 are self-explanatory with one possible exception. Two of the seven hydroelectric plants in the Recommended Plan now have an installed capacity of 235 megawatts and produce 1,398 gigawatt hours of electric power for system-type use. These two plants would be enlarged in capacity to 510 megawatts, be operated for peaking, and generate 1,427 gigawatt hours annually compared to 1,398 gigawatt hours under present conditions. Five other potential hydroelectric plants are proposed for additional study and would have an installed capacity of 183 megawatts under the NED Plan and 383 under the Recommended Plan. Annual generation under either plan would be 836 gigawatt hours of energy.

Comparison of Alternative Plan Effects

The following table summarizes comparative data for the NED, EQ and Recommended Plans by account and component.

As a follow-up to the earlier table that summarized the needs and opportunities, table 39 presents the beneficial and adverse effects under each of four accounts: (1) national economic development, (2) environmental quality, (3) regional development and (4) social well-being. To facilitate comparisons, columns 2, 3 and 4 show the effects for the Recommended Plan and columns 5 to 8 those for the NED and EQ plans. For certain components data were available only for the entire study area.

Particularly for the EQ account, it has been necessary in some cases to include only qualitative expressions of response. These brief expressions relate to recommendations discussed earlier in Chapter V.

In the regional development and social well-being accounts, several types of entries are included to allow certain economic and social effects to be shown, e.g., value to users, additional income accruing to residents, regional economic base and stability, net beneficial employment, initial funding of the programs, measures of security for life/health/safety and educational/cultural/recreational opportunities. Most entries are self-explanatory, but others require clarification.

The employment figures shown have been confined to that generated directly by the components on a full time basis for 713 jobs comprising their operation/maintenance/replacement requirements (OM&R), and the operation of new farms. They exclude the short term employment for construction and development activities, and also the indirect employment stemming from the many forms of economic activity stimulated by the recommended components.

As concerns the additional average annual income accruing to residents from the OM&R and new-farm activities of $12,748,000, there must be recognition also for the average annual value to users of increased goods and services aggregating $121,291,000 and the average value of increased, stabilized and redistributed income aggregating $79,408,000. As shown in both the regional development and social well-being accounts, the aggregate of these three types of added income would average $213,447,000 if all recommended components were implemented by the year 2000.

Whereas the NED account is confined to direct beneficial and adverse effects, the regional development and social well-being accounts reflect both these direct and other indirect effects. Using the aggregate OM&R and new farm employment numbers, these were multiplied by assumed average annual incomes to derive total planning area and study area incomes. These multipliers were $17,000 for all components but hydroelectric power which was $20,000. To estimate representative values for "Increase, Stabilize, Redistribute Income," formulas were developed that were applied to costs, benefits, and/or annual incomes for OM&R and new farms to derive the social impacts in monetary terms. Generally speaking, the formulas reflect economic procedures in regular agency practice. For both new and supplemental irrigation, the induced goods and services impact was taken as 60 percent of the annual direct user benefits. For construction of the above, about 35-40 percent of the annual construction investment, and for O, M&R, 60 percent of its annual cost was used. For hydroelectric power, annual construction and O, M&R impacts were assumed the same as irrigation. For land and water conservation and flood control, the impact was estimated as double the annual O, M&R salary cost and for fish, wildlife and recreation, five times the annual O, M&R salary cost.

Population impacts as shown were confined to those resulting from direct employment in operation, maintenance or general management of the components once implemented, and that of new farms added. Total population reflects an estimate of three people comprising each added family from either new employees or additional farm units.

Federal and nonfederal funding was estimated for each type of component following general governmental policy, recognizing in instances intended state or local sponsorship. The federal-nonfederal cost distribution varies by components but overall shows that the Recommended Plan might require about $1,200,000,000 in initial federal funds and $118,000,000 from non-federal sources through the year 2000. The federal share is affected heavily by inclusion of the hydroelectric plants, water conservation program and irrigation projects, having initial aggregate costs of 647,252, and 272 million dollars, respectively. Inclusion of local funding responsibilities of operation and maintenance, and future repayment of these initial investments, would significantly increase the nonfederal share.

Table 39
COMPARISON OF ALTERNATIVES PLANS — STUDY AREA

Account and Component	Recommended Plan (RP) Provided From			National Economic Development Plan (NED)		Environmental Quality Plan (EQ)	
	NED	EQ	Total	Provided	(5) vs (4)	Provided	(7) vs (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
National Economic Development, Beneficial and Adverse Effects							
A. Value of Increased Outputs/Goods/Services and Value of Resources			(thousand dollars)				
1. Agriculture (Irrigation)[a, m]							
Total Cost	257,725	14,527	272,252	266,657	-5,595	14,527	257,725
Annual Cost	19,420	1,000	20,420	20,145	-275	1,000	19,420
Annual Benefits	27,281	1,000	28,281	28,385	104	1,000	27,281
2. Agriculture (Water Conservation Program)[a, n]							
Total Cost	251,635	0	251,635	229,560	22,075	0	251,635
Annual Cost	17,107	0	17,107	15,441	-1,666	0	17,107
Annual Benefits	28,462	0	28,462	26,872	1,590	0	28,462
3. Land and Water Conservation Measures (Acceleration)[a, e]							
Total Cost	0	36,101	36,101	0	-36,101	36,101	0
Annual Cost	0	3,438	3,438	0	-3,438	3,438	0
Annual Benefits	0	NA	NA	0	NA	NA	0
4. Flood Control							
Total Cost	18,524	1,197[h]	19,721	18,309	-1,412	1,197[h]	18,524
Annual Cost	1,333	90	1,423	1,318	-105	90	1,333
Annual Benefits	2,000	90[p]	2,090	1,993	-97	90[p]	2,000
5. Streambank Erosion[q]							
Total Cost	0	9,995	9,995	0	-9,995	9,995	0
Annual Cost	0	770	770	0	-770	770	0
Annual Benefits	0	NA	NA	0	NA	NA	NA
6. Fish and Wildlife							
Total Cost	5,529	8,970	14,499	5,529	-8,970	1,394,790[r]	1,380,291
Annual Cost	404	787	1,191	404	-787	117,898	116,687
Annual Benefits	534	332[p]	866	534	-332	332[p]	534
7. Outdoor Recreation							
Total Cost	18,427	46,926[s]	65,353	14,481	-50,872	46,926[s]	18,427
Annual Cost	1,328	3,970	5,298	1,045	-4,253	3,970	1,328
Annual Benefits	1,629	50[p]	1,579	1,629	50	50[p]	1,629
8. Hydroelectric Power[t]							
Total Cost	646,945	0	646,945	475,232	-171,713	0	-646,945
Annual Cost	46,819	0	46,819	34,365	-12,454	0	-46,819
Annual Benefits	59,855	0	59,855	51,896	-7,959	0	-59,855
9. Municipal and Industrial Water[u]							
Total Cost	685	0	685	685	0	0	-685
Annual Cost	51	0	51	51	0	0	-51
Annual Benefits	58	0	58	58	0	0	-58
10. Total Plan							
Total Cost	1,199,470	117,716	1,317,186	1,010,453	-306,733	1,501,556	184,370
Annual Cost	86,462	10,055	96,517	72,719	-23,798	129,148	32,631
Annual Benefits	119,819	1,472	121,291	111,367	-9,924	1,472	-118,819

Table 39 (Continued)

Account and Component	Recommended Plan (RP) Provided From			National Economic Development Plan (NED)		Environmental Quality Plan (EQ)	
	NED	EQ	Total	Provided	(5) vs (4)	Provided	(7) vs (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Environmental Quality, Beneficial and Adverse Effects				(units as shown)			
A. Open/Green Spaces, Wild/Scenic/Recreational Rivers, Lakes and Areas of Natural Beauty							
1. Create Lakes (surface acres)	16,168	0	16,168	16,168	0	0	-16,168
2. Public Recreation Areas—Carrying Capacity, Use, Winter and General Access (M Dollars)	0	46,200	46,200	0	-46,200	46,200	0
3. State Recreation Rivers (Studies/miles)	0	6/696	6/696[k]	0	-6/696	6/630	-66
4. Wild/Scenic/Recreation Rivers (Studies/national)	Local/State efforts for stream protection through year 1990. If unsuccessful, federal assistance will be sought after 1990.						
B. Archeological, Historical, Biological and Geological Resources: Selected Ecological Systems							
1. Identify Critical Habitat for Threatened/Endangered Species	0	X	X	0	-X	X	0
2. Preserve Unique Areas (acres)	Enact state/federal legislation to protect natural landmarks/historic sites.						
3. Preserve/Enhance Wildlife Areas (acres)	0	0	0	0	0	641,940	641,940
4. Improve Wildlife Habitat—Stockwater Ponds (acres)	0	1,150	1,150	0	-1,150	1,150	0
5. Lose Stream Fishery (miles)	90.3	0	90.3	90.3	0	0	-90.3
6. Add Lake/Reservoir Fishery (acres)	5,845	0	5,845	5,845	0	0	-5,845
7. Adopt Adequate Instream Flow Levels (X)	0	X	X	0	-X	X	0
8. Fish/Wildlife Enhancement—Public Lands (M acres)	0	161	161	0	-161	161	0
C. Quality of Water, Air and Land Resources							
1. Accelerate Land Treatment (M acres)[a]	22	1,520	1,542	22	-1,520	1,520	-22
2. Revegetation Techniques—Streambank Erosion	Encourage added research and pilot programs for better control of areas.						
3. Improve Water Quality by Low Stream Flow Augmentation (miles)	224	0	224	224	0	0	-224
4. Stream Flow Degradation—Chemical Content of Return Flows—Reduce (R), Increase (I).	R-I	R	R-I	-I	0	R	-
5. Alleviate Streambank Erosion (bank miles)	0	60[g]	60	0	-60	60[g]	0
6. Salt Diversions and Pickup Reduction—Water Conservation Program (M tons)	333	0	333	333	0	0	-333
7. Study, Provide Technical Aid, Alleviate Saline Seep (M dollars)[e]	0	6,000	6,000	0	-6,000	6,000	0
D. Irreversible Commitment of Resources to Future Uses							
1. Conversion of Agricultural Land, Terrestrial Habitat, etc. to Reservoirs (acres)	16,168	0	16,168	16,168	0	0	-16,168
2. Conversion of Riparian Habitat to Other Uses (acres)		0				0	
3. Stream Flow Depletion—Added Irrigation (acre-feet)	257,850	0	257,850[b]	250,100	-7,750	0	-257,850
4. Stream Flow Depletion—Supplemental Irrigation (acre-feet)	112,900	0	112,900	112,900	0	0	-112,900
5. Stream Flow Depletion—Energy Industry (acre-feet)	25,000	0	25,000	25,000	0	0	-25,000
6. Stream Flow Depletion—Stockwater Ponds/Wildlife (acre-feet)	0	3,000	3,000	0	-3,000	3,000	0

Table 39 (Continued)

Account and Component	Recommended Plan (RP) Provided From			National Economic Development Plan (NED)		Environmental Quality Plan (EQ)	
	NED	EQ	Total	Provided	(5) vs (4)	Provided	(7) vs (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			(thousand dollars)				
Regional Development, Beneficial and Adverse Effects							
A. Value to Users of Increased Goods/Services—Study Area Residents (Annual Benefits)							
1. Agriculture (Irrigation Incl. Water Conservation Prog.)	55,743	1,000	56,743	55,263	-1,480	1,000	-55,743
2. Land and Water Conservation Measures (Accelerated)	0	NA	NA	0	NA	NA	NA
3. Flood Control	2,000	90	2,090	1,993	-97	90	-2,000
4. Streambank Erosion	0	NA	NA	0	NA	NA	NA
5. Fish and Wildlife	534	332	866	534	-332	332	-534
6. Outdoor Recreation	1,629	50	1,679	1,629	-50	50	-1,629
7. Hydroelectric Power	59,855	0	59,855	51,896	-7,959	0	-59,855
8. Municipal and Industrial Water	58	0	58	58	0	0	-58
9. Total Plan	119,819	1,472	121,291	111,373	-9,918	1,472	-119,819
B. Additional Income Accruing to Residents (OM&R & New Farms)							
1. Agriculture (Irrigation Incl. Water Conservation Prog.)	7,306	34	7,340	7,595	255	34	-7,306
2. Land and Water Conservation Measures (Accelerated)	476	2,590	3,066	476	-2,590	2,590	-476
3. Flood Control	34	40	74	34	-40	40	-34
4. Streambank Erosion	0	17	17	0	-17	17	0
5. Fish and Wildlife	68	170	238	68	-170	9,490	9,252
6. Outdoor Recreation	51	442	493	34	-459	442	-51
7. Hydroelectric Power	1,520	0	1,520	800	-720	0	-1,520
8. Total Plan	9,455	3,293	12,748	9,007	-3,741	12,613	-135
C. Increase, Stabilize, Redistribute Income							
1. Agriculture (Irrigation Inc. Water Conservation Prog.)	40,967	600	41,567	41,112	-455	600	-40,967
2. Land and Water Conservation Measures (Accelerated)	952	5,180	6,132	952	-5,180	5,180	-952
3. Flood Control	68	80	148	68	-80	80	-68
4. Streambank Erosion	0	34	34	0	-34	34	0
5. Fish and Wildlife	340	850	1,190	340	-850	19,490	18,300
6. Outdoor Recreation	255	1,210	2,465	255	-2,210	2,210	-255
7. Hydroelectric Power	27,872	0	27,872	21,312	-6,560	0	-27,872
8. Total Plan	70,454	8,954	79,408	64,039	-15,369	27,594	-51,814
			(units as shown)				
D. Net Beneficial Employment—Number of Jobs—Full Time							
1. Agriculture (Irrigation Incl. Water Conservation Prog.)	407	2	409	424	15	2	-407
2. Land and Water Conservation Measures (Accelerated)	28	152	180	28	-152	152	-28
3. Flood Control	2	2	4	2	-2	2	-2
4. Streambank Erosion	0	1	1	0	-1	1	0
5. Fish and Wildlife	4	10	14	4	-10	570	556
6. Outdoor Recreation	3	26	29	2	-27	26	-3
7. Hydroelectric Power	76	0	76	40	-36	0	-76
8. Total Plan	520	193	713	500	-213	753	40

Table 39 (continued)

Account and Component	Recommended Plan (RP) Provided From			National Economic Development Plan (NED)		Environmental Quality Plan (EQ)	
	NED	EQ	Total	Provided	(5) vs (4)	Provided	(7) vs (4)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
E. Regional Economic Base and Stability—To Year 2000							
1. Convert Dry Land to Irrigated Agriculture (acres)	172,876[b]	0	172,876	181,476	8,600	0	-172,876
2. Improve Irrigation Systems (acres)	780,000	0	780,000	780,000	0	0	-780,000
3. Provide Supplemental Irrigation Water Supply (acres)	314,790	0	314,790	314,790	0	0	-314,790
4. Land and Water Conservation Measures (Accelerated) (M acres)[a]	22	1,520	1,542	22	-1,520	1,520	-22
5. Hydroelectric Power Production							
a) Electrical Generation Capacity (megawatts)	893.5	(235)[l]	893.5	693.5	-200	0	-893.5
b) Electrical Generation (gigawatt hours/year)	2,263	(1,398)[l]	2,263	2,263	0	0	-2,263
F. Total Plan—Initial Funding ($1,000)[a]							
1. Federal Cost	1,057,199	86,281	1,143,480	877,796	-265,684	749,191	-394,289
2. Nonfederal Cost	142,271	31,435	173,706	132,657	-41,049	754,345	580,639
3. Total Cost	1,199,470	117,716	1,317,186	1,010,453	-306,733	1,503,536	186,350
Social Well-Being, Beneficial and Adverse Effects			(units as shown)				
A. Effects on Value to Users and Real Incomes[a]							
1. Value to Users of Increases Goods/Services - Study Area Residents (Annual Benefits - M Dollars)	119,819	1,472	121,291	111,367	-9,924	1,472	-119,819
2. Additional Income Accruing to Residents (OM&R & new Farms - M Dollars)	9,455	3,293	12,748	9,007	-3,741	12,613	-135
3. Increase, Stabilize, Redistribute Income (M Dollars)	70,454	8,954	79,408	64,039	-15,369	27,594	-51,814
4. Total Plan (M Dollars)	199,728	13,719	213,447	184,413	-29,034	41,679	-171,768
B. Security of Life, Health and Safety							
1. Provide Flood Protection, Urban Area (acres/people)	2,722/3,450	0	2,722/3,450	2,722/3,450	0	0	-2,722/3,450
2. Complete Flood Plain Surveys-Administer Flood Plain Management Program	0	X	X	0	-X	X	0
3. Provide Flood Regulation by Reservoirs (acre-feet)	847	0	847	847	0	0	-847
4. Reduce (R) Increase (I) Water Pollution	R-I	R	R-I	R-I	0	R	--
5. Added Dependable Food Supplies (X)	X	0	X	X	0	0	-X
6. Added Energy Supplies (X)	X	0	X	X	0	0	-X
7. Population Impact (no.)	1,560	579	2,139	1,500	-639	2,259	120
C. Educational, Cultural and Recreational Opportunities							
1. Added Hunting (hunting days)[u]	NA	NA	NA	NA	NA	NA	NA
2. Added Fishing (fishing days)[v]	112,600	0	112,600	112,600	0	0	-112,600
3. Added Recreation (recreation days)[v]	535,000	15,000	550,000	535,000	-15,000	15,000	-535,000
4. Added Social/Health/Education Pressures—Construction Related (X)	X	0	X	X	0	0	-X

Land Use Impacts

Tables 38 and 39 show a variety of potentials for meeting needs or realizing opportunities that have both water and land use impacts. Table 40 summarizes the major land use shifts proposed by the Recommended Plan.

Several aspects of the Recommended Plan and its prospective land use shifts are significant in terms of impact on the basic agricultural economy of the study area. The potential exists to provide some 314,800 acres of currently irrigated land with needed supplemental water and to convert nearly 173,000 acres from nonirrigated to irrigated cropping.

Reservoirs to augment or regulate water supplies for irrigation, hydroelectric power and other uses would shift over 16,000 acres from agricultural land and terrestrial habitat to aquatic uses. Most of this land would be taken out of dryland cropping, range and pasture but require also terrestrial and other wildlife habitat and scenic vegetation along the 90 miles of stream so affected. About 10,500 acres of land around the reservoirs, and within their necessary take lines, could be devoted to wildlife, recreation and other water based uses.

Many of the components are directed at conservation efforts. Those affecting primarily land use involve, among others, a 25 percent acceleration of land and water and conservation measures applied to 1,542,000 acres of federal, state, and private lands. State technical aid and direct assistance would be provided for 100,000 or more acres of agricultural land now affected adversely by saline seep. Completion of flood plain surveys by the state and other delegated agencies would permit adequate administration and added protection where a million acres are now adversely affected and the projected year 2000 average annual damages exceed $10 million.

Another winter sport - snowmobiling

Table 40
LAND USE CONVERSIONS OF RECOMMENDED PLAN

Planning Area	Irrigated Cropland (New)	Nonirrigated Cropland	Range, Dry Pasture & Barren	Forest, Woodland, Unique Area Preservation	Outdoor Recreational Development or Use		Fish and Wildlife Areas, Preservation, Development or Use	
					Land	Water	Land	Water
				(acres)				
Upper Missouri Tributaries	11,357	-11,887	-4,356	1,040	286	1,750	95	1,715
Missouri-Marias	141,155	-143,445	-16,096	869	2,000	5,100	5,299[a]	5,118
Missouri-Musselshell	--	--	-1,166	--	25	250	413[b]	478
Milk (Including St. Mary)	--	--	-1,637	--	41	500	453	643
Missouri-Poplar	20,364	-21,209	-688	--	Relocation of Land/Facilities to area downstream		1,311[c]	222
Upper Missouri Study Area	172,876	-176,541	-23,943	1,909	2,352	7,600	7,571	8,176

[a] Of total 2,117 acres are located at potential reservoirs/ponds.
[b] Of total 323 acres are located at potential reservoirs/ponds.
[c] Excludes 200 acres of woodlands and 100 acres of shrubs shifted from private to public ownership—designation and control but no change in use.

About 161,000 acres of public land would be improved in terms of better fulfilling wildlife habitat needs. Also, measures to be installed near existing and federally-assisted stockwater ponds aggregating about 1,150 acres would enhance wildlife habitat. There is a recognized need to preserve and enhance riparian habitats, but there is a present lack of adequate data on their extent and rate of loss. A study should be completed to investigate their status and to identify measures to protect and enhance the dwindling habitat area.

A recommendation is made to limit the use of public recreation areas to their carrying capacity, encourage the use of underutilized areas, and provide appropriate access to these and winter use areas through public and private property. Recognizing the foregoing needs nd that the study area already contains over 15 million acres of public land and water, greater coordination of actions, improved management, and access are recognized as important elements in responding to expected demands of these kinds.

Recommended studies for nearly 700 miles along six rivers would be undertaken looking to state/local protection, as found practicable, to preserve their wild, scenic and other recreation values. New and amended state and federal legislation could provide for better protection of unique natural landmarks and historic sites. Well-recognized are the hazards inherent in unplanned residential and urban development and transformation of land areas better suited to other uses. Amended state legislation is recommended to improve the mechanics of land use planning.

Water Use Impacts

The Recommended Plan includes potentials to both increase and decrease the present magnitude, quality, and availability of surface and ground water supplies.

The irrigation of some 1,284,000 acres of land was analyzed and shows: (1) high volume water diversions, (2) a high degree of inadequate conveyance and return systems, (3) a shortage of over 800,000 acre-feet in average annual water supply, and (4) an overall water use efficiency of but 20 percent. In the Water Conservation Program, improvements to both on- and off-farm facilities and improved water management could reduce average annual diversions by 1,260,000 acre-feet, salt diversions and pick up by 339,000 tons per year, and seepage losses by 1,049,000 acre-feet. Measures to increase available water supply include improved diversions, pumping, and ground water use aggregating 203,000 acre-feet; improved water management 830,000 acre-feet; and added storage regulation 600,000 acre-feet. This would reduce the present water shortage and increase the overall water efficiency to 35 percent for the study area. By the year 2000 perhaps 25 percent of the program could be accomplished under the FWO plan and an additional 50 percent under the Recommended Plan. Overall, the change in these operations attributable to the RP would increase streamflow depletions by possibly 70,430 acre-feet. This depletion and added supplemental service on one major component (Milk River) would increase the depletions from supplemental water service in the RP to 112,900 acre-feet. Added hydroelectric power reservoir evaporation losses are expected to cause 25,000 acre-feet of depletions and wildlife stockpond uses, 3,000 acre-feet.

The projected streamflow depletions in the study area are summarized in table 41. This takes the contemplated usage by both the FWO and RP into account in terms of gross withdrawals and depletions. Much of the increased water use shown would be accomplished utilizing the savings already described for the water conservation program together with the yield of off season flows taken into about 615,000 acre-feet of added storage, primarily for supplemental irrigation. In addition, 900,000 acre-feet of reservoir storage, provided primarily for hydroelectric power production, would substantially regulate all of the river water supplies with streamflow depletions limited to added reservoir evaporation.

Table 41 shows net streamflow depletions by the Recommended Plan would average about 400,000 acre-feet annually. The FWO plan depletions would be nearly as much, at 350,000 acre-feet, taking into account the several uses shown in the table, including those on the Poplar River in Canada. Altogether, this would impose a depletion of about 11 percent of the 1975 depleted level average annual flow of the Missouri River near Culbertson, Montana at the eastern edge of the study area.

Table 41
YEAR 2000 ESTIMATED AVERAGE ANNUAL WATER WITHDRAWALS AND DEPLETIONS OVER 1975 CONDITIONS

Use	Without Plan		Recommended Plan		Total	
	Withdrawals	Depletion	Withdrawals	Depletion	Withdrawals	Depletion
	(acre-feet)					
Supplemental Water	-616,355[a]	35,170	-1,147,880[a]	112,900	-1,764,235[a]	148,070
New Irrigation	524,200	226,600	599,200	257,850	1,123,400	484,450
Municipal and Rural						
Domestic Water	80,000	32,000	---	---	80,000	32,000
Livestock Water	27,000	27,000	---	---	27,000	27,000
Livestock Ponds—Wildlife	400	400	3,000	3,000	3,000	3,000
Nonenergy Industrial	21,700	7,000	---	---	21,700	7,000
Energy—Electrical Hydro						
Reservoir Evaporation	---	---	25,000	25,000	25,000	25,000
Thermal—Montana	[b]	16,100	---	---	[b]	16,100
Poplar River Power Reservoir--Canada (1-4 units)	2,000/7,800	2,000/7,800	---	---	2,000/7,800	2,000/7,800
TOTAL	44,745	352,070	-520,680	398,750	-476,335	750,420

[a]Minus figures represent reductions attributable to application of improvements to existing irrigation systems in the Water Conservation Program.
[b] Not Available.

Socioeconomic Impact

Impacts on the study area's social and economic structure would take many forms. A few of these have been estimated.

For employment the additions have been confined to those involved in the full-time operation, maintenance, and general management of the recommended components and new farms in the year 2000. As explained earlier, the population increase was confined to that due to these same operations, but excluding the indirect population impacts.

Concerning increased average annual income, the estimates for the year 2000 take the three forms shown in table 42: (1) the direct value to users of increased outputs of goods and services and value of resources; (2) that accruing to the OM&R employees and new farm operators; and (3) the estimated increase, stabilization, and redistribution of income with implementation of the recommended components--these reflect both direct and indirect effects stemming from construction as well as continuing operation and management.

Table 42 shows the estimates from indicated sources for the future without and recommended plans for several socioeconomic factors. Whereas the employment, population, and value of increased goods and services have been restricted to more or less direct effects of the recommended plan components, the indirect results in the broader basis of increase, stability and redistribution of income would be greater due to the workings of the total economic impact value shown.

Table 42
UPPER MISSOURI RIVER BASIN
LEVEL B STUDY
SOCIOECONOMIC FACTORS, YEAR 2000

INDEX	WITHOUT PLAN	RECOMMENDED PLAN[a]		
		NED	EQ	Total
Employment	131,300[b]	520[f]	193[f]	713[f]
Annual Income ($1000)	1,721,305[c]	199,728	13,719	213,447
1. Value-Increased Outputs/Goods/Services		119,819	1,472	121,291
2. Residents (OM&R and New Farms)		9,455	3,293	12,748
3. Increase, Stabilize, Redistribute Income		70,454	8,954	79,408
Population—Projected (number)	301,400[d] 371,200[e]	1,560[f]	579[f]	2,139[f]

[a] Direct employment, annual income and population.
[b] Table 26—Socio-economic Characteristics and Projections Technical Paper—Upper Missouri River Basin Level B Study.
[c] Table 8—as above.
[d] Table 25—as above. Low projections.
[e] Table 25—as above. Medium projections.
[f] Only that resulting from direct employment in operation, maintenance, and general management of components and new farms once implemented; excludes indirect population impacts.

CHAPTER VI

CONCLUSIONS AND FUTURE ACTIONS

Chapter V describes the components of the management plan recommended for the water and related land resources of the Upper Missouri River Basin. This chapter briefly describes the steps or actions required to implement the Recommended Plan.

Conclusions

The plan has the capability of providing varying levels of satisfaction of needs and opportunities identified for several functional uses. In some cases, the FWO satisfies the projected needs or requirements. Some of the functional uses whose needs would be satisfied in the FWO are livestock water, municipal and rural domestic water supply, and nonenergy industrial water supply.

Land treatment measures included in the RP would provide about 14 percent of the total needs remaining following the FWO. Flood control measures would reduce the year 2000 projected damages about 23 percent. The opportunities identified for irrigation would be fulfilled if all the potential projects included in the RP were implemented. On the other hand, streambank erosion measures have the potential for reducing the projected miles of erosion by less than three percent.

The RP would also improve water quality as a result of streamflow reservations and reduction in salt pick-up. Certain wildlife habitat enhancement opportunities would be met through construction of facilities on stockwater ponds and other improvements on public lands. More divergent and efficient uses of public recreation lands as well as additional opportunities for lake fishing would be possible under the RP. However, 90 miles of streams would be lost.

Some of the plan elements associated with environmental protection will require broad-based cooperation if they are to become reality. Examples include riparian habitat preservation and wildlife habitat protection.

In general, the RP offers a balanced combination of economic and environmental elements which provide a degree of satisfaction for both objectives. The fact that all functional needs were not satisfied illustrates several possible situations. One is that trade-offs have been made between alternative plans and a second is that the state of the art of planning does not permit an assessment of future needs or complete satisfaction to be attained, given the constraints imposed.

Spillway rehabilitation of Tiber Dam spillway.

Plan Implementation

Several actions will be necessary to implement plan elements. These include funding for additional studies to refine those programs showing potential for implementation, legal and institutional changes necessary to improve or initiate programs, and funding for construction or other forms of implementation.

A suggested schedule for implementation of the proposed plan elements, showing the actions needed as well as the suggested time periods, appears in table 43.

Future Actions

Designation of responsibilities and required future actions are described in the following section. They are shown by program function but no preference or priority is intended in the order of listing.

Program Implementation And/Or Acceleration

The U.S. Congress should:

--provide funding to the Soil Conservation Service for construction of Browning and Boulder River Watershed Projects.

--provide funding to the Corps of Engineers for construction of the Great Falls Local Flood Protection Project.

--continue to fund the best management practices identified in the 208 Water Quality Management Plans.

--increase funding for the Soil Conservation Service, Agricultural Stabilization and Conservation Service, Forest Service, and Bureau of Land Management to provide for a 25 percent acceleration in the installation rate of soil and water conservation practices.

--provide funding to the Water and Power Resources Service, Soil Conservation Service, Agricultural Stabilization and Conservation Service, and Agricultural Extension Service to allow them to install measures and provide technical services to improve irrigation water management and operation efficiency.

--fund the Soil Conservation Service, Forest Service and Corps of Engineers to enable the continuation of development of revegetation techniques as a possible means of streambank erosion control.

--provide funding to the Bureau of Land Management and Forest Service for implementation and enhancement of fish and wildlife habitat programs on public lands. The Sikes Act should be implemented so authorized features can be installed on public lands and installation of wildlife habitat measures at stockwater ponds should be accelerated at a rate of 60 percent above the current rate.

--consider the demonstrated needs for solving the Muddy Creek erosion problem and provide funds for its solution.

The Secretary of the Interior should provide for designation of critical habitat for threatened and endangered species as provided for under the Endangered Species Act of 1973 as amended (P.L. 93-205).

For those projects identified in the final environmental impact statement, each lead agency should conduct an impact reduction or avoidance process in association with the level C feasibility planning. A task force approach, utilizing agencies with expertise in environmental problems is suggested. Agencies which should participate include State environmental agencies, Water and Power Resources Service, Fish and Wildlife Service, Soil Conservation Service, Agricultural Stabilization and Conservation Service, Corps of Engineers, and the Environmental Protection Agency.

The Montana Legislature should:

--fund the Department of Fish, Wildlife and Parks to permit an acceleration of wildlife habitat protection through a multi-program

Table 43
SCHEDULE FOR RECOMMENDED PLAN IMPLEMENTATION

Plan Element	Action Required			Lead Agency	Time of Action	
	Construction Funding	Legislation or Policy	Additional Study		By 1990	By 2000
Agriculture						
Milk River Supplemental Service			X	WPRS		X
Gallatin Unit			X	WPRS		X
Clarkston Unit			X	WPRS		X
Chestnut Valley Unit			X	WPRS		X
Lower Marias Unit			X	WPRS	X	
Bonanza Unit			X	WPRS		X
Diamond Ranch Unit			X	WPRS		X
Fort Charles Unit			X	WPRS		X
Calais Unit			X	WPRS		X
Farmer Creek Unit			X	WPRS		X
Poplar Unit			X	WPRS		X
Wapiti Unit			X	WPRS		X
Water Conservation	X			WPRS	X	
Fish and Wildlife						
Wildlife Programs on Public Lands	X			BLM,FS	X	
Stockwater Ponds Measures	X			BLM	X	
Critical Habitat Designation			X	FWS	X	
Riparian Habitat Protection			X	FWS, DFWP	X	
Provide Instream Flows		X	X	DFWP, DNRC	X	
Wildlife Habitat Protection		X		DFWP	X	
Flood Control						
Bozeman Creek Watershed			X	SCS	X	
Browning Watershed	X[a]			SCS	X	
Wolf Creek Watershed			X	SCS		X
Great Falls Local Flood Protection	X			CE	X	
Hydropower						
Gibson Dam			X	WPRS	X	
Tiber Dam			X	WPRS	X	
Broadwater Dam			X	DNRC	X	
Canyon Ferry Dam			X	WPRS	X	
Fort Peck Dam			X	CE	X	
Land Conservation						
Accelerated Land and Water Conservation Measures	X			SCS, FS, BLM	X	X
Saline Seep	X[b]			DNRC	X	
Land Use Planning						
Amend Legislation		X		DCA	X	
Acceleration of Flood Plain Management	X[b]			DNRC	X	
Outdoor Recreation						
Coordinate Management of Public Areas		X		HCRS, NPS, DFWP	X	
Enact Natural Landmark Legislation		X		DFWP		X
Amend Montana Antiquities Act		X		DFWP, MHS	X	
Study Protected River Systems			X	DFWP	X	
Streambank Erosion Control						
Revegetation	X[b]		X	SCS, FS	X	
Water Quality						
Implement 208	X[b]			CD	X	
Muddy Creek	X			EPA, ASCS	X	
Ennis Lake Thermal			X	Blue Ribbons of the Big Sky APO	X	
Multi-Purpose						
Boulder River Watershed	X[a]			SCS	X	
Fort Benton Unit			X	WPRS	X	

[a] Funding authorized subsequent to January 1978
[b] Implementation funding

WPRS—Water and Power Resources Service
BLM—Bureau of Land Management
FS—Forest Service
FWS—Fish and Wildlife Service
DFWP—Department of Fish, Wildlife and Parks
DNRC—Department of Natural Resources and Conservation
SCS—Soil Conservation Service
ASCS—Agricultural Stabilization and Conservation Service
CE—Corps of Engineers
DCA—Department of Community Affairs
HCRS—Heritage Conservation and Recreation Service
NPS—National Park Service
MHS—Montana Historical Society
CD—Conservation Districts
EPA—Environmental Protection Agency
APO—Areawide Planning Organization

approach. This includes: identification of critical areas, continuation of the habitat acquisition program, and implementation of incentive strategies with landowners.

--increase the funding for the Montana Department of Natural Resources and Conservation to encourage an acceleration in the flood plain delineation and subsequent flood plain management program.

--provide funding, through the Renewable Resources Development Fund, to the Madison Thermal Pollution Steering Committee to enable the committee to identify and implement the best solutions to the Madison River thermal pollution problem.

--increase funding to the Department of State lands so the Abandoned Mine Regulation Program can be expanded to control acid mine wastes as they occur.

--make funds available to local conservation districts for use in reducing and preventing the occurrence of saline seep areas.

--provide funding to the county land planning fund to support local planning efforts.

Sponsors of the Newlan Creek Watershed Project, the Meagher County Newlan Creek Water District, Meagher County Soil and Water Conservation District, and Meagher County Commissioners should investigate possible funding sources to complete the project. Potential sources are the small projects loan program of the Water and Power Resources Service and the Resource Indemnity Trust Fund through the Montana Legislature.

The Muddy Creek Task Force is encouraged to continue pursuit of attainable solutions to improve the Muddy Creek erosion problem.

Local conservation districts are urged to:

--expand the present saline seep reduction program now underway in the Triangle Area Conservation Districts.

--Implement the best management practices to reduce nonpoint pollution as identified in the 208 Water Quality Management Plans.

Program Studies and Management

The U.S. Congress should:

--provide funding to the Water and Power Resources Service to conduct feasibility studies on the following potential irrigation projects: the Lower Marias, Gallatin, Clarkston, Chestnut Valley, Milk River Supplemental, Bonanza, Diamond Ranch, Fort Charles, Calais, Farmer Creek, Poplar, and Wapiti Units.

--provide funding to the Water and Power Resources Service and Corps of Engineers for completion of feasibility studies on potential hydropower projects at Gibson, Tiber, Canyon Ferry, and Fort Peck Dams. These studies should adequately consider the mitigation needs of fish and wildlife as provided for in the Fish and Wildlife Coordination Act.

--provide funding to the Soil Conservation Service for feasibility studies on Bozeman Creek, Wolf Creek and Gibson Flats watershed projects and initial planning studies on Ten Mile Creek, Willow Creek and Lower Birch Creek small watershed projects. In addition, the Soil Conservation Service should identify the potential for land treatment watershed projects.

--fund the Water and Power Resources Service as lead agency and other agencies as cooperators in a comprehensive energy-environmental study of the Missouri River from Helena to Fort Benton.

The Water and Power Resources Service is encouraged to complete the reformulation study now underway on the Fort Benton Unit. Environmental impacts and the river fluctuations in the wild and scenic reach of the Missouri River need to be analyzed as a part of this effort.

Public land managing agencies within the Departments of the Interior and Agriculture and the State of Montana, who are responsible for public recreation areas, should coordinate their activities to provide better management of these areas. Activities include: 1) limiting the use of recreation areas to carrying capacity, 2) encouraging use of underutilized areas, and 3) providing adequate access.

The Missouri River Basin Commission should annually analyze progress on implementation of this plan and use that information in establishing priorities and maintaining the regional water resources management plan.

The Montana Legislature should:

--provide funds for a design study by the Department of Natural Resources and Con-

servation on a potential hydropower project at Broadwater Dam.

--fund the Departments of Natural Resources and Conservation and Fish, Wildlife and Parks to study the impacts of potential transfer of existing appropriative water rights to a use for maintenance of instream flows.

--fund the Department of Fish, Wildlife and Parks to lead an interagency task force in developing a program for the preservation and enhancement of riparian habitat. This program should include: 1) an inventory, 2) documentation and classification of habitat, 3) determination of rate and cause of habitat loss, and 4) recommendation of strategies for preservation.

The Montana Department of Fish, Wildlife and Parks and other appropriate state agencies should cooperate with local governments and citizen groups in considering ways to protect and preserve unique and scenic river reaches. Incentive methods to provide for the protection without fee title purchase appear to be most desirable.

Legislation

The Montana Legislature should:

--enact legislation to provide for the identification and protection of natural landmarks.

Central Montana near Missouri Breaks Region.

--amend the Antiquities Act of 1979 to allow for regulations similar to those in the National Historic Preservation Act to be applied to sites eligible for the National Register of Historic Places.

--amend the Subdivision and Platting and County Zoning Enabling Acts to provide local governments with adequate authority to implement land use planning measures.

APPENDIX A
FINAL ENVIRONMENTAL IMPACT STATEMENT

ABSTRACT

The proposed action is a management plan for water and related land resources in the Upper Missouri Subbasin. Prepared by the Missouri River Basin Commission, it includes 49 elements and recommendations for implementation. The environmental impact statement is designed to provide an evaluation of impacts of the Recommended Plan, and is intended to assist decisionmakers in choosing among a variety of alternative solutions in the development and conservation of the study area's resources. Impacts of this plan are displayed individually and collectively for programs and projects related to irrigated agriculture, fish and wildlife, flood control, hydropower, water quality, land conservation and management, land use planning, and outdoor recreation.

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SUMMARY

People in the study area want to improve water resources management so that all water demands for agricultural, industrial, and municipal purposes can be met without adversely affecting valuable portions of the natural environment. The water and related resource management plan recommended for achieving this objective, was prepared under direction of the Commission's Upper Missouri River Basin Level B Study Management Board. It identifies 49 elements and recommendations to address and meet future water resource management needs and opportunities.

This environmental impact statement (EIS) was also prepared under direction of the Upper Missouri River Basin Level B Study Management Board. It is intended to meet legal requirements of the National Environmental Policy Act of 1969 and subsequent procedural requirements of the U.S. Council on Environmental Quality and the U.S. Water Resources Council.

This EIS references and summarizes the environmental impacts of several alternative plans developed during the level B planning process. Focus, including supplemental analysis, is on the recommended plan. Impacts of the 35 Recommended Plan elements, actions which exhibit implementation potential, were determined by evaluation of 26 factors relating to the environment, and are summarized by illustration in the EIS. Impacts of the 14 Recommended Plan recommendations, actions which appear to have merit, are discussed following the elements in each functionally-related category. Additional emphasis was placed on identifying the significant direct, indirect, and cumulative impacts for each group of functionally-related actions.

The net overall effect of the Recommended Plan implementation on the environment would be beneficial. Over the long term, agricultural productivity would be enhanced through supply of additional water to lands currently short of water. The impact of new water supply development on water quality and present water supplies of the study area would be reduced through accelerated water conservation and water quality management programs. In addition, the plan provides for protection and preservation of fish and wildlife resources, protection of soil resources, reduction of flood damages, and development of new hydropower sources. Additional analysis, to be conducted during feasibility or design studies, is needed on several projects to fully define and mitigate potential adverse environmental impacts.

Significant issues or conflicts raised during the planning process relate to water depletions associated with irrigation and other water use projects, alteration of stream or lake habitat by hydropower projects, control of urban flooding, and identification and preservation of wildlife habitat needs. Irreversible and irretrievable commitments of resources associated with plan implementation are also described.

PURPOSE OF AND NEED FOR ACTION

The purpose of this environmental impact statement is to summarize and further evaluate the Recommended Plan developed in the Upper Missouri River Basin Level B Study. The strategies proposed for management of water and related land resources during the next 15 to 20 years are the result of a 30-month comprehensive planning effort bringing together some 49 elements and recommendations in 11 resource function categories.

Assessment of the plan impacts is required by the National Environmental Policy Act (NEPA). Details of appropriate assessment procedures are provided in regulations of the Council on Environmental Quality (CEQ) (40 CFR, Parts 1500 through 1508) and Water Resources Council (WRC) (18 CFR, Part 707). Section 707.8 (a)(1)(ii) of the WRC regulations states that level B plans normally require an environmental impact statement (EIS).

As a water and related land resources planning agency, the Missouri River Basin Commission also complies with the WRC's directives entitled Principles and Standards (P & S). These rules require that alternative plans emphasizing environmental quality and national economic development be prepared in addition to a recommended plan, and that the impacts of these alternative plans be displayed within four accounts: national economic development, environmental quality, regional economic development, and social well-being. While this analysis overlaps with NEPA-related analysis (18 CFR, Section 707.5), the processes can be integrated (40 CFR, Section 1506.4; 18 CFR, Section 707.5). Regulations of the WRC encourage the integra-

tion of P & S and NEPA analysis into a single document whenever possible

The regulations of CEQ (Sections 1500.4 (g)(i); 1501.7; 1502.4, 1502.20) and WRC (Sections 707.5 (c), 707.9, 707.10) require the assessment process to identify only significant issues relevant to the assessment effort (scoping) and to keep environmental effects detail at the same level as planning and evaluation data (tiering). The CEQ regulations also provide other means to reduce bulk and paperwork such as incorporating significant data by reference (Section 1502.21), combining the NEPA documents with other documents (Section 1506.4), integrating environmental review and consultation requirements (Section 1502.25), and using categorical exclusions (Section 1508.4).

Scoping activities relating to identification of important environmental issues were completed during early planning processes. These issues were analyzed in a series of technical papers: fish and wildlife, environmental characteristics, land and water conservation measures, water quality, and outdoor recreation. These papers identified needs to preserve or enhance the following resources: (1) instream flows; (2) various wildlife habitats, including riparian; (3) stream environmental quality (fisheries, esthetics, man-made intrusions, wildlife); (4) water quality; (5) wetlands; (6) fish and wildlife populations, including endangered and threatened species; (7) historic and archeological; (8) soil resources; and (9) the recreational resource base. This information provided the basis for subsequent planning and assessment considerations which led to formulation of the environmental quality plan. Later, it provided the basis for evaluation of tradeoffs between the EQ and NED plans as the Recommended Plan was being formulated.

Tiering was used to keep plan and environmental effects information at the same level of detail. Environmental effects data which had been developed for site-specific projects were too detailed and had to be generalized for display in a form appropriate for level B analysis. Other information available from statewide or other very geographically-broad reports had to be made more specific.

This environmental impact statement, including referenced portions of the Upper Missouri Level B report, addresses the impacts of individual plan elements and recommendations for a wide range of environmental factors, analyzes the effects of alternative courses of action, and addresses direct, indirect, and cumulative effects. It also addresses other NEPA-related concerns found in Section 1502.16 of the CEQ rules and regulations (environmental consequences). These include: (1) adverse environmental effects which cannot be avoided, (2) relationship between local short-term uses of man's environment and the enhancement of long-term productivity; and (3) irreversible and irretrievable commitment of resources which would be involved in the proposed action should it be implemented. Further, significant impacts of individual or cumulative nature are highlighted so that level C environmental analyses can identify modifications designed to minimize or avoid adverse effects. In addition, various State and Federal environmental legislative or executive initiatives promulgated subsequent to the National Environmental Policy Act of 1969 are listed to assist Federal and State agencies in meeting environmental requirements during plan implementation.

ALTERNATIVES INCLUDING PROPOSED ACTION

The Upper Missouri River Basin Level B Study utilized a multi-objective planning process as required by the Water Resources Council's Principles and Standards. The planning process included an estimate of the future without a plan, identification of an alternative which increases the output of the Nation's goods and services (National Economic Development Plan), identification of an alternative which enhances the quality of the environment (Environmental Quality Plan), and preparation of the recommended plan.

The Future Without A Plan (FWO), the "no action" alternative of the study, is a look at the future with none of the actions proposed in the plan. Table 38[1] shows the FWO meets several of the identified needs for year 2000, i.e., nonirrigated crop area, municipal and rural domestic water supply, livestock water supply, nonenergy industrial water supply, and recreational facility development. The remaining needs or opportunities, the greatest being for irrigated agriculture, land and water conservation, flood control, fish and wildlife, and hydropower, were focal points of the alternative plans.

[1]All numeric tables referenced are in the main report, however, they are considered an integral part of this EIS

The objective of the National Economic Development Plan (NED) is to enhance economic development by increasing the national output of goods and services. Accordingly, an alternative was developed to produce the highest net economic benefit. It is composed of 26 elements within the functional areas of irrigation, hydropower, and flood control. Tables 32 and 39 identify impacts of the NED plan and table 38 its capability for meeting needs and opportunities remaining after the FWO.

The NED plan elements related to irrigation negatively affect energy, water quality, outdoor recreation, wildlife populations, and stream habitats. Those relating to hydropower could have a slight negative effect on outdoor recreation and stream-related fish and wildlife habitat. At times, both irrigation and hydropower projects could have short-term adverse impacts on community and individual well-being. Most NED elements, however, show long-term beneficial effects on social and cultural factors, i.e., increase of agricultural productivity, population, and employment. In addition, the hydropower projects significantly add to the region's existing energy supply, while flood control projects would reduce flood damages.

The objective of the Environmental Quality Plan (EQ) is to enhance the quality of the environment. The EQ plan is composed of 18 elements classified according to water quality, land and water conservation, fish and wildlife, recreation, and land use planning. Tables 33 and 39 identify impacts of the EQ plan and table 38 its capability of meeting needs and opportunities remaining after the FWO. Because of the explicit purpose of the EQ plan, most effects on the environment are beneficial. Slight adverse effects on water supply occur, caused by land and water conservation, fish and wildlife, and water quality (208) programs. In addition, the fish and wildlife programs may induce some indirect negative effects on productivity of agricultural lands. Some EQ programs also limit the range of future land uses.

The Recommended Plan (RP) shown in table 35 is composed of elements from the NED and EQ alternative plans as previously described and shown in tables 32 and 33. In some cases, these plan elements were modified as they moved from the alternative plans to the RP in order to reduce environmental impact, provide a greater degree of flood protection, and reflect State and local concerns about specific projects or programs. The effects of these modified elements are shown in Chapter V and table 36. In addition, the study made recommendations (table 37) in several functional areas to meet an identified need or problem not addressed by the NED or EQ alternatives or reflected in revisions or adjustments made in NED or EQ plan elements.

Table 39 summarizes impacts of the RP and table 38 its capability of meeting needs and opportunities remaining after the FWO. Overall, the Recommended Plan for the Upper Missouri River Basin moderates the environmental impacts induced by the NED plan elements. Additional steps, outlined later in this environmental statement, further describe level C coordination procedures for avoiding or mitigating residual adverse effects. While the RP does not totally meet all needs or opportunities by year 2000, the plan provides an improved and practical approach for management of the study area's water and related land resources.

PLANNING SETTING

The planning environment of the study area varies from the wooded mountain slopes along its southern and western sides to the broad, grassy plains of its northern, central, and eastern portions. Within this expanse is a wide variety of plant and animal life adapted to the specific climate and topography of individual regions.

The mountainous regions of the study area are dotted with alpine meadows and lakes. Many brooks and streams rise in these mountainous areas and provide cold water fisheries of State and national significance. Important warm water fisheries occur in streams and reservoirs in the plains portion of the study area.

The mountainous areas are partly covered with coniferous forests which grade into open woodlands and shrub grasslands at lower elevations. The high plains and lower foothills to the east make up a sea of grass broken by pine or juniper woodlands, isolated uplifts of rock, and streams and rivers. Large areas of the plains in the study area have been converted to crop monocultures. However, vegetation along stream valleys affords ecological diversity, and in glaciated areas north of the Missouri River, wetlands provide further landscape contrast.

This large and ecologically diverse region supports a wide variety of wildlife. Deer, elk, and antelope are found in large numbers. Elk and

mule deer are confined mainly to the mountains and higher elevations while antelope and white-tail deer inhabit the plains and river bottoms. Black, and to a lesser extent grizzly bear, bighorn sheep, Rocky Mountain goats, moose, and mountain lions live in the mountainous regions. Other important furbearers, upland game birds, and waterfowl are also found there. A number of endangered and threatened animals besides grizzly bear inhabit the study area.

Agriculture is the dominant economic activity in the study area, led by production of dryland small grains and livestock. Wheat occupies the largest single acreage, followed by barley and oats. Irrigated crops comprise a relatively small percentage of cultivated acreage but contribute heavily to total production, alfalfa being the leading crop.

In livestock ranching, cattle predominate in animal numbers. Sheep production has declined steadily since 1960 but remains a major enterprise in parts of the study area.

Several large reservoirs have been constructed on the Missouri River and its tributaries in the study area. These reservoirs along with the unimpounded stream sections provide water for agriculture, hydropower, recreation, and fish and wildlife. Large acreages of national forest and national wildlife refuge lands important for supplying wood products, recreational opportunities, and preservation of wildlife occur in the study area.

With diverse and varied human motivations, it is inevitable that conflicts arise regarding use of the water and related land resources. The sportsman and recreationist seek protection for certain resources while the farmer and rancher must employ some of the same resources in their operations. Finding a reasonable and workable balance is the challenge facing planners and decision-makers.

More specific information about the study area's resources is provided in Chapter II of the report and in the 15 technical papers prepared for the study.

ENVIRONMENTAL CONSEQUENCES

Impacts of the Recommended Plan

This section contains impact information on each plan element, recommendation and functional category (irrigated agriculture, fish and wildlife, flood control, hydropower, land conservation and management, land use planning, water quality, and outdoor recreation.) The type, duration, and relative magnitude of the impact of each plan element within each group is shown in an environmental impact matrix (table A-1). Impacts are described for physical and chemical, cultural, social, and biological factors. The information displayed in the matrix table is based on more detailed impact data found in the display of beneficial and adverse effects of the NED, EQ, and Recommended Plans (tables 32, 33, and 36) and in tables dealing with cumulative and irreversible effects (tables 39 and 41). This information was developed by an interagency study team composed of specialists with a variety of backgrounds in the natural, engineering, and social sciences (see 'List of Preparers' later in this EIS).

Additional work on probable impacts on flood plains and wetlands were developed by MRBC staff using available data. In general, a slight negative effect was assigned to projects in the flood plain unless the development would be balanced by project-associated flood plain benefits such as enhancement of fish and wildlife, protection of soil resources, protection of structures, or reduction of existing hazardous flood plain uses. In level C planning flood proofing and other measures should be considered to avoid or minimize damages to project-related structures.

The purpose of the short narrative discussion of impacts for each functional category is to highlight those effects which are most significant in terms of the proposed action and planning setting, and to emphasize areas of environmental concern which need further analysis by the responsible agency.

Irrigated Agriculture

Table A-2 lists the projects and programs which constitute plan elements for irrigated agriculture. Additional detail is provided in table 32.

Tables A-1 and 32 show that several environmental factors would be affected by implementation of these projects. In general the magnitude of impact increases as the affected geographic area increases, i.e., the Lower Marias Unit, designed to provide water for 127,000 acres of new lands, has a greater variety and magnitude of impacts than the Clarkston Unit, which would irrigate 985 acres of new land. Table A-1 also indicates that data are generally lacking for impacts affecting environ-

TABLE A-1
ENVIRONMENTAL IMPACTS OF RECOMMENDED PLAN

LEGEND

- ++ Significant Beneficial
- + Slight Beneficial
- O Little or No Effect
- — Slight Adverse
- —— Significant Adverse
- —+ Short Term Adverse, Long Term Beneficial
- +O Short Term Beneficial, Long Term Little or No Effect
- —O Short Term Adverse, Long Term Little or No Effect
- □ Data Not Available

			PLAN ELEMENTS																		
			IRRIGATION														FISH & WILDLIFE				
			Gallatin Unit	Clarkson Unit	Chestnut Valley Unit	Lower Marias Unit	Milk River Suppl	Bonanza Unit	Diamond Ranch Unit	Ft Charles Unit	Calais Unit	Farmer Creek	Poplar Unit	Wapiti Unit	Water Cons Meas	Boulder River	Public Land Program (Sikes Act)	Installation of Meas at Stockwater Ponds	Critical Habitat Designation	Preservation or Enhmt of Riparian Habitat	Wildlife Habitat Protection
ENVIRONMENTAL FACTORS	PHYSICAL & CHEMICAL	Water Depletions	—	—	—	—	—	—	—	—	—	—	—	—	—	—	□	—	O	O	O
		Flood Plain	O	—	—	—	—	—	—	—	—	—	—	—	O	—	O	O	O	+	+
		Channel Morphology	□	O	O	□	—	O	O	O	O	O	O	O	O	O	O	O	O	+	O
		Water Quality	—	—	—	• (Milk) — (Marias)	O	—	—	—	—	—	—	—	+	O	O	+	O	+	+
		Air Quality	—O	—O	—O	—+	+	O	O	—O	—O	O	—O	—O	O	O	O	O	O	O	O
		Soil	O	O	O	+	+	O	O	O	O	O	O	O	O	O	O	+	O	+	+
		Energy	—	—	—	O	—	—	—	—	—	—	—	—	+	□	O	O	O	O	O
	CULTURAL	Agricultural Lands	+	+	+	+	+	+	+	+	+	+	+	+	+	+	O	O	—	—	—
		Historic and Archaeological Sites	□	□	□	□	□	□	□	□	□	□	□	□	O	O	O	O	+	O	O
		Esthetics	—	—	—	O	—	—	—	—	—	—	—	—	O	O	+	+	+	+	+
		Outdoor Recreation	O	O	O	—	O	—	—	—	—	—	—	—	O	+	+	+	O	+	+
		Legal and Institutional	O	O	O	—	□	O	O	O	O	O	O	O	O	O	O	O	O	—	O
	SOCIAL	Land Use Conflict	O	O	□	□	—	O	O	O	□	O	O	O	O	O	—	O	—	—	—
		Population	+	O	+	++	+	O	O	+	+	O	+	+	+	O	+	O	O	O	O
		Employment	+	+	+	++	+	+O	+O	+	+	+O	+	+	+	+	+	O	—	O	O
		Community Well-Being	—+	O	—+	—+	—+	O	O	+	—+	O	+	+	+	+	—	O	—	O	O
		Individual Well-Being	—+	O	—+	—+	—+	O	O	+	—+	O	+	+	+	+	+	O	O	O	—+
	BIOLOGICAL — POPULATIONS	Fish	□	O	O	— (Marias)	—	O	O	O	O	O	O	O	+	+	+	+	O	+	O
		Big Game	O	O	O	—	—	—	—	—	—	—	—	—	O	—	+	+	O	+	+
		Upland Game	O	+	+	O	—	—	—	—	—	—	—	—	—	O	+	+	O	+	+
		Endangered and Threatened Species	O	□	□	□	□	□	□	□	□	□	□	□	O	O	+	O	+	+	+
		Migratory Waterfowl	O	O	—	+	+	O	O	O	+	+	+	+	—	O	+	+	O	+	+
	BIOLOGICAL — HABITAT	Instream	—	O	O	• (Milk) — (Marias)	—	O	O	O	O	O	O	O	+	+	+	O	O	+	+
		Wetland	O	O	—	□	—	□	□	□	□	□	□	□	—	□	+	+	O	+	+
		Rangeland	O	□	□	—	—	O	O	□	□	□	□	□	O	—	+	+	+	O	+
		Riparian	O	O	—	—	—	—	—	—	—	—	—	—	O	—	+	O	+	++	+

			PLAN ELEMENT															
			FLOODING					HYDROPOWER						LAND CONSERVATION		AND USE PLANNING	WATER QUALITY	
			Bozeman Creek Watershed	Browning Watershed	Great Falls Land Flood Protection Proj	Wolf Creek Watershed	Gibson Flats Watershed	Gibson Dam	Tiber Dam	Broadwater Dam	Canyon Ferry Dam	Fort Peck Dam	Fort Benton Dam	Alcel Land & Water Conservation	Saline Seep	Flood Plain Management	Implement 208 Programs	Muddy Creek
ENVIRONMENTAL FACTORS	PHYSICAL & CHEMICAL	Water Depletions	O	O	O	O	O	O	O	O	O	—	—	—	—	O	—	•
		Flood Plain	O	O	—	O	—	O	O	O	O	—	— —	O	O	•	•	•
		Channel Morphology	O	O	O	O	O	O	O	O	O	—	—	•	•	O	•	•
		Water Quality	•	•	O	O	O	O	O	O	□	□	□	•	•	•	•	•
		Air Quality	O	O	O	O	O	—O	—O	—O	—•	—•	—•	•	O	O	O	O
		Soil	•	•	O	O	•	O	O	O	O	O	O	• •	•	•	•	•
		Energy	O	O	O	O	O	•	•	•	• •	• •	• •	O	O	O	O	•
	CULTURAL	Agricultural Lands	O	O	—	O	O	O	O	O	O	—	—	•	•	•	•	•
		Historic and Archaeological Sites	O	•	O	□	□	O	O	O	O	□	□	O	O	O	O	O
		Esthetics	O	•	O	O	O	—	—	•	—	—	—	•	•	•	•	O
		Outdoor Recreation	O	O	O	O	O	O	O	•	—	—	—	•	•	•	•	O
		Legal and Institutional	O	O	O	O	O	O	O	O	O	O	—	O	O	O	O	•
	SOCIAL	Land Use Conflict	O	O	—	O	O	O	O	O	O	—	—	O	O	—	O	O
		Population	O	O	O	O	O	•	•	•	•	•	• •	O	O	O	O	•
		Employment	O	•	•O	O	O	•	•	•	•	•	• •	•	•	O	O	•
		Community Well-Being	•	•	•	•	•	—O	—O	—O	—O	—O	—	•	•	•	•	—•
		Individual Well-Being	•	•	•	•	•	—O	—O	—O	—O	—O	—	•	•	•	•	—•
	BIOLOGICAL — POPULATION	Fish	O	•	O	O	O	□	—	O	—	— —	Native • Stocked	•	•	•	•	•
		Big Game	O	O	O	O	O	O	O	O	O	—	— —	•	O	O	•	O
		Upland Game	O	O	O	O	O	O	O	O	O	O	□	•	•	O	•	•
		Endangered and Threatened Species	O	O	O	O	O	O	O	O	O	□	□	O	O	O	O	O
		Migratory Waterfowl	O	•	O	O	O	O	—	O	O	—	—	•	•	•	•	□
	BIOLOGICAL — HABITAT	Instream	O	O	O	O	O	O	O	O	—	—	—	•	•	•	•	•
		Wetland	O	•	O	O	O	O	O	O	O	□	—	•	•	•	•	□
		Rangeland	O	O	O	O	O	O	O	O	O	O	□	•	O	O	•	O
		Riparian	O	O	O	O	O	O	—	O	O	—	— —	•	O	•	•	O

TABLE A-2

IRRIGATED AGRICULTURE PLAN ELEMENTS

Plan Element	Affected River(s) & Planning Area	Counties	Size (acres)[a] New		Suppl.	Agency[b]
Gallatin Unit	Gallatin (1002)	Gallatin	7,957	**59,096**	51,139	WPRS
Clarkston Unit	Missouri (1002)	Gallatin	985	**985**	---	WPRS
Chestnut Valley Unit	Missouri (1003)	Cascade	4,470	**6,360**	1,890	WPRS
Lower Marias Unit	Marias (1003) Milk (1005)	Liberty Chouteau, Hill	19,970 107,030	**127,000**	--- ---	WPRS
Milk River, Supplemental Service	Missouri-Milk (1005)	Chouteau, Hill	---	**108,140**	108,140	WPRS
Bonanza Unit	Missouri (1006)	Richland	800	**800**	---	WPRS
Fort Charles Unit	Missouri (1006)	McCone	3,187	**3,187**	---	WPRS
Calais Unit	Missouri (1006)	Roosevelt	6,410	**6,410**	---	WPRS
Diamond Ranch Unit	Missouri (1006)	Roosevelt	900	**900**	---	WPRS
Farmer Creek Unit	Missouri (1006)	McCone	888	**888**	---	WPRS
Poplar Unit	Missouri (1006)	Roosevelt	4,440	**4,440**	---	WPRS
Wapiti Unit	Missouri (1006)	McCone	3,739	**3,739**	---	WPRS
Boulder River Watershed	Boulder R (1002)	Jefferson	3,400	**10,700**	7,300	SCS
Fort Benton Unit	Missouri (1003)	Chouteau	8,700	**8,700**	---	WPRS
Water Conservation Measures	Basinwide	---	All Irrigated Lands			WPRS SCS
		GRAND TOTAL	172,876	**341,345**	168,469	

[a]Totals for irrigation are underlined
[b]WPRS, Water and Power Resources Service; SCS, Soil Conservation Service.

mental factors such as endangered and threatened species, historic and archaeological sites, rangeland, and wetland Additional data will be needed in future feasibility studies to identify impacts on these resources Such studies should also include an evaluation of the impacts on vector populations and vector-borne diseases.

Overall, social factors and agricultural lands would be positively affected by the irrigation projects. On a cumulative basis some 341,345 acres of land could receive additional water If that were to occur, long-term employment opportunity in those project areas could increase by 409 workers, and an additional $280 million of goods and services would be produced annually. These circumstances would help stabilize economic and social sectors of the affected area, and provide additional foodstuffs for export.

The Federal irrigation projects, over and above ongoing private development, could cause an ultimate depletion of 370,750 acre-feet from the Missouri River near the Montana-North Dakota border, or about 5 percent of the current average annual flow (table 41). The negative effect on existing instream uses downriver would be nominal, with the exception of hydropower generation, where maximum losses could reach 251 gigawatt hours annually. This represents a potential annual loss of $2.5 million in revenues, based on return rates to the U.S. Treasury for operation of the main stem reservoirs. (This analysis was provided by the Bureau of Land Management, Montana State Office, in consultation with Water and Power Resources Service and the Corps of Engineers.)

Most of the irrigation projects have slight adverse effects on environmental factors including water quality, fisheries, wildlife habitat, game populations, and instream values. Specific water quality impacts, i.e., increased sediment loads during construction and increased nutrient and total dissolved solids, could result from return flows of the Gallatin, Chestnut Valley, Lower Marias, Milk River Supplemental, and Fort Charles Units. On a cumulative basis, several smaller irrigation projects along the Missouri River main stem below Fort Peck Reservoir could have adverse effects on riparian habitat and other environmental values. Indirect effects on esthetics and recreation are generally considered to be minor or at least could be avoided To the extent possible, the impacts of these projects should be further defined in level C studies so that adverse impacts are minimized or avoided

The direct impact of the water conservation program, through improvements to both on- and off-farm facilities and improved water management, is significant in terms of reducing diversions and improving water quality The effect would be to reduce average annual stream and reservoir diversions by 1,147,880 acre-feet annually (table 41) over existing conditions or about 18 percent. That is slightly more than the possible new diversions (1,123,000 acre-feet) for private and Federal irrigation development (table 41) Because of the proposed water conservation program, less salt (table 39) and sediment would enter streams each year in return flow An indirect effect of the program, reduction of wildlife habitat through canal rehabilitation, could be remedied through site-specific mitigation efforts.

Two recommendations for irrigated agriculture are also part of the proposed action. These are. (1) Newlan Creek Watershed Project, recommended for funding, and (2) the Lower Birch Creek Project, recommended for study by the Soil Conservation Service. Potential impacts of these projects, in Meagher and Teton Counties (area 1003), are not available at this time.

Fish and Wildlife

The plan elements for fish and wildlife resources are displayed in table A-3. Additional detail is provided in table 33.

In terms of implementation at the field level, the fish and wildlife elements collectively deal with the complex and pervasive problem of declining habitat availability and quality in the study area The first three programs listed in table A-3 are more readily implementable, with the latter two requiring further studies and coordination with other water and land resource programs The impacts of these latter two, therefore, are only tentative at this time.

As shown in tables A-1 and 33, the direct environmental impacts of the elements are largely positive. In general, they provide for the improvement of terrestrial and aquatic habitat for a wide range of wildlife, particularly on public lands The three habitat programs involving management of private lands have more potential for indirect negative effects. Some social (land use conflict) and cultural (loss of food and fiber production) effects are inevitable. On the other hand the recreational and esthetic resource base would be enhanced and preserved, which could attract new population growth

Table A-3

FISH AND WILDLIFE PLAN ELEMENTS

Plan Element	Planning Area	Scope	Agency[a]
Implement fish & wildlife programs on public lands (Sikes Act)	Entire subbasin where applicable	161,300 acres	FWS, BLM FS, WPRS COE, MFWP
Installation of measures at stock water ponds	Entire subbasin where applicable	1,150 ponds	ASCS, BLM FS, MFWP
Critical habitat designation	Entire subbasin where applicable	---	FWS
Riparian habitat protection	Along major streams	---	MFWP
Wildlife habitat protection	Entire subbasin where applicable	---	MFWP

[a]FWS, Fish and Wildlife Service,
BLM, Bureau of Land Management;
FS, Forest Service;
COE, Corps of Engineers;
MFWP, Montana Department of Fish, Wildlife and Parks;
ASCS, Agriculture Stabilization and Conservation Service.

In addition to plan elements displayed in table A-3, the plan recommends as part of the proposed action a study to determine the impact of changing State water law to authorize transfer of water rights from agriculture, industrial, or municipal purposes to instream flow purposes for protection and enhancement of fish and wildlife resources. The study would have no direct effects, but its results could lead to changes in State water law which would permit beneficial water use transfers on a voluntary basis.

On balance, the fish and wildlife water-related programs would protect and preserve a significant portion of the fish and wildlife resources in the study area, with their State and national values. Impacts on other public and private uses of the land and water resources would be negligible.

Flood Control

Plan elements to control the effects of flooding are displayed in table A-4. Additional detail is provided in table 32.

The direct environmental effect of the listed projects would be generally positive (tables A-1 and 32) with no significant adverse impact on physical, chemical, or biological relationships. Project installation would reduce the accustomed, periodic, high water exposure to personal security and property damage, and would bring accessory benefits to the community social and cultural environment. As project implementation might affect vector populations and vector-borne diseases, these issues should be evaluated in future feasibility studies.

Corollary programs proposed under the "Land Use Planning" heading would help regulate new construction of damage-susceptible improvements in flood plain areas.

In addition to the flood control elements, the plan recommends a feasibility study of the Ten Mile Creek Watershed Project in Lewis and Clark County, Planning Area 1003. Impacts of that recommendation are not available.

Hydropower

The plan elements to increase hydropower in the study area are displayed in table A-5. Additional detail is provided in table 32.

Table A-4

FLOOD CONTROL PLAN ELEMENTS

Plan Element	Planning Area	County	Agency
Bozeman Creek Watershed	1002	Gallatin	SCS
Browning Watershed	1003	Glacier	SCS
Great Falls Local Flood Protection Project	1003	Cascade	COE
Wolf Creek Watershed	1004	Fergus	SCS
Gibson Flats Watershed	1003	Cascade	SCS

Tables A-1 and 32 indicate that impacts for the small hydropower projects (Gibson, Tiber, and Broadwater) are minimal. These projects involve installation of electrical generators at existing facilities which are not peaking operations, and they do not require modification of present reservoir operation schedules.

The other projects (Canyon Ferry, Fort Peck, and Fort Benton) are proposed peaking operations, and in addition for Fort Peck and Fort Benton require construction of impoundments. Therefore, environmental impacts on instream flow, fish and wildlife, and recreational values can be expected. Impacts of the Canyon Ferry project (tables A-1 and 32) are tentative pending results of further studies that fully describe the duration and extent of water fluctuations below the existing dam. Once this information is available, the implementation agency, working with appropriate environmental agencies, can better determine the type and magnitude of impacts and how to deal with them.

Adverse environmental impacts of the Fort Peck and Fort Benton projects are predictable. At Fort Peck an afterbay reservoir would be required to re-regulate peak flows downriver from the main dam. The major adverse effects on the local environment would result from inundation of eight miles of riverine habitat possessing important fisheries value.

The Fort Benton reservoir would submerge a 30-mile, free-flowing reach of the Missouri River; the potential flooded area now consists of river-

Table A-5

HYDROPOWER PLAN ELEMENTS

Plan Element	Affected River & Planning Area	County	Size	Agency[a]
Gibson Dam	Sun (1003)	Lewis & Clark	7 5 MW	WPRS
Tiber Dam	Marias (1003)	Liberty	5 0 MW	WPRS
Broadwater Dam	Missouri (1002)	Broadwater	9 8 MW	DNRC
Canyon Ferry Dam	Missouri (1003)	Lewis & Clark	90 0 MW	WPRS
Fort Peck	Missouri (1005)	Valley & McCone	185 0 MW	COE
Fort Benton	Missouri (1003)	Chouteau	360 0 MW	WPRS

[a]DNRC, Montana Department of Natural Resources and Conservation

bottom habitat and irrigated farm land. Mitigation problems at Fort Benton would be more formidable than at Fort Peck due to the character and productivity of impacted lands (tables 32 and 35).

Indirect beneficial impacts of hydropower projects are related to the avoidance of impacts associated with operation of fossil fuel and other types of electrical generating plants, especially the effects on air quality, land, and mineral resources. Construction of recommended hydropower projects could eliminate the need to construct fossil-fuel peaking plants in the study area in the near future.

Cumulative and indirect adverse environmental effects of projects on the Missouri River between Helena and Fort Benton are of special concern. Part of the proposed action recommends that the Water and Power Resources Service, in cooperation with other agencies, conduct a comprehensive study to examine in detail energy-environmental effects (table 37). On other portions of the Missouri River, cumulative effects of the hydropower projects are not an identifiable concern.

Land Conservation and Management

Table A-6 lists the conservation projects and programs which are elements of the plan. Additional detail is provided in table 33.

Tables A-1 and 33 show the various environmental factors that would be affected by implementation of these projects. Generally conservation programs would have beneficial effects on soil and agricultural resources. Acceleration of land and water conservation measures would provide significant direct benefits because of the additional acreage treated above that envisioned by the future without plan. Related indirect benefits would accrue to such factors as channel morphology, water quality, esthetics, recreation, employment, community and individual well-being, and wildlife populations and habitat. Adverse effects most probably would be limited to increased water depletion resulting from added plant growth produced by certain conservation measures. This impact, however, would be small, and its significance slight.

The land and water conservation practices would cumulatively affect a total of 1.6 million acres of land, or about 8 percent of the 20.6 million acres identified in the land treatment "remaining needs" category, as of 1975 (table 20). In addition, accelerated conservation measures would provide permanent employment for 178 persons and indirectly improve wildlife populations and habitat.

The plan recommends that additional pilot programs for streambank erosion control (table 37), utilizing nonstructural techniques, be established and monitored. Monitoring should include an evaluation of environmental impacts, especially those relating to channel morphology, flood plain, water quality, esthetics, soil resources, fish and wildlife habitat, and vector control.

Table A-6

LAND CONSERVATION AND MANAGEMENT PLAN ELEMENTS

Plan Element	Planning Area	Scope	Agency
Accelerated land and water conservation	Entire study area as applicable	1,520,136 acres	SCS, FS, BLM
Saline seep	Plains areas	100,000 acres	DNRC

Land Use Planning

Table A-7 lists the single land use planning element of the plan. Additional detail is provided in tables 33 and 35.

Tables A-1 and 33 show that several environmental factors would be affected by an accelerated flood plain management program. A slight beneficial impact would accrue to nearly all aspects of the human environment (cultural, social, physical, and biological) because natural flood plain values would be preserved and human populations would be restricted from locating in situations where there is a high risk of loss of life and property. The flood plain management program indirectly but specifically would benefit other factors such as water quality, soil, agricultural lands, esthetics, outdoor recreation, and some wildlife populations and habitat. The only significant adverse social aspect of the program is related to potential land use conflicts which restrict the use of flood zones

The plan (table 37) recommends that State law be amended to allow local jurisfictions comprehensive control over urban development and to fund local planning efforts from the coal severance tax. While specific impact data for such action cannot be obtained at this time, it is likely that flood plains, water quality, soil, agricultural, and community and individual well-being could be benefitted slightly, and potential land use conflicts could be resolved as a result of these actions.

Water Quality

The water quality elements of the plan are listed in table A-8. Additional detail is provided in tables 33 and 35.

Table A-7

LAND USE PLANNING PLAN ELEMENTS

Plan Element	Planning Area	Agency
Flood plain management	Riverine flood plains throughout the study area	DNRC

Table A-8

WATER QUALITY PLAN ELEMENTS

Plan Element	Planning Area	County	Agency[a]
Implement 208 Programs	Entire study area as applicable	All	Conservation Districts, DHES, DNRC, EPA, FS, BLM
Muddy Creek	Missouri-Marias	Cascade & Teton	Conservation Districts, EPA, ASCS, DHES, SCS, WPRS

[a]DHES, Montana Department of Health and Environmental Services, EPA, Environmental Protection Agency
EPA, Environmental Protection Agency

Tables A-1 and 33 show how water quality would benefit through implementation of these programs. Indirect benefits would accrue to flood plain, channel morphology, soil, agricultural lands, employment, community and individual well-being, upland game, stream, and rangeland factors. Implementation of the water quality management programs (208) would slightly increase water depletion because of increased consumptive use by added vegetative cover. As planning activities continue on the Muddy Creek project, its effects on historic and archeological sites and wildlife populations and habitat must be identified.

Cumulatively, these projects would improve the study area's water quality. Small employment gains would benefit several communities where construction, operation, and maintenance, and processing of goods and services would occur.

The plan (table 37) also recommends study of thermal pollution on the Madison River and that additional financial resources be made available for control of acid mine drainage. Mine drainage control could lead to improvement of water quality on several mountain streams. Future activities in these areas should identify specific environmental impacts of the recommended programs.

Outdoor Recreation

The recommended plan does not contain specific elements for outdoor recreation. However, several broad recommendations pertinent to this topic, such as provision for access, enactment of natural landmark legislation, amendment of Montana's Antiquities Act, and study of selected stream segments with potential for wild and scenic designation (table 37) are included. Each of these recommendations would benefit outdoor recreation opportunities in the subbasin by protection of valuable portions of the resource base. Historic, archeological, and natural areas also would be protected. Some programs may increase water and related land use conflicts at the local level and others would require legislative or institutional change. During further program evaluation, the range and magnitude of environmental impacts from such actions should be determined by the implementing agency.

Two multipurpose projects, the Boulder River Watershed Unit and the Fort Benton Hydropower Project (table 35) also create additional opportunity for outdoor recreation. The former provides added opportunities for stream and lake-oriented recreation. Environmental impacts related to Fort Benton Unit, however, need to be further identified and quantified during future studies.

Adverse Environmental Effects Which Cannot be Avoided Should the Action be Implemented

Adverse environmental effects are identified in table A-1 and in tables 32, 33, 34, and 39. Major adverse environmental effects which cannot be avoided for various reasons include: (1) a maximum additional cumulative net depletion of 398,750 acre-feet surface water from the Missouri River; (2) loss of over 90 miles of free-flowing streams and adjacent riparian lands to reservoir construction; (3) inundation of 16,168 acres of river bottomland important for fish and wildlife habitat and crop production; (4) loss of antelope and other wildlife habitat through conversion of rangeland to cropland; and (5) loss of agricultural lands resulting from construction of pumping plants, power lines, canals, and access roads.

The added depletions cannot be mitigated; they represent slightly more than five percent of current average annual Missouri River main stem flow at the Montana-North Dakota border. Present planning related uncertainties could affect that figure in the future, however, particularly energy-related and irrigation developments and degree of implementation of water conservation efforts.

Loss of stream wildlife habitat could be mitigated to some degree if funding for land acquisition and habitat development were made a prerequisite to project construction. While stream fishery habitat cannot be replaced by development of lake fisheries, riparian habitat mitigation could be done through acquisition and intensive management of unaffected upstream and downstream segments or by the vegetation of reservoir shorelines. This endeavor, however, could create land-use competition with agricultural interests for fertile bottomlands. There may also be a need for mitigation of antelope winter range if those areas are encroached upon by water projects.

Lost bottomland crop production could not be replaced easily because of the relative scarcity of suitable alternative sites. It may be possible to increase irrigation on adjacent lands, however, to make up part of this loss.

Loss of agricultural lands due to construction of irrigation facilities could be reduced by careful site selection and planning

Relationship Between Local Short-term Uses of Man's Environment and the Enhancement of Long-term Productivity

The Recommended Plan is designed to use the study area's water and related land resources to enhance the quality of the environment for current and succeeding generations. Short-term commitments of resources would be made so that social, cultural, economic, and environmental amenities would be available over the long term.

Short-term uses of resources committed to implementation of the proposed plan include use of fossil fuels, labor, and construction equipment and materials. During construction periods affected areas would experience increased levels of noise, traffic, soil erosion, siltation of streams, disturbance of vegetation and fish and wildlife resources, and influx of workers who require community services.

Long-term agricultural productivity and added rural population stability would result from programs related to irrigation, soil and water conservation measures, and water quality. These programs would reduce soil loss, waste of water supplies, and deterioration of water quality. Flood control and flood plain management programs over the long term would reduce the flood hazard and regulate urban-related development in flood prone areas. Hydropower projects would supply clean and cheap electric power, thereby reducing dependence on foreign and domestic fossil fuel supplies and the resultant adverse environmental impact. Various fish and wildlife and other environmental-related programs would protect important instream, riparian, and big game habitats needed to sustain the quality fish and wildlife resources of the study area

Endangered and threatened species programs would protect species such as the grizzly bear, American peregrine falcon, northern swift fox, gray wolf, black-footed ferret, and whooping crane for the enjoyment by future generations.

Plan recommendations for additional study of various proposed programs and projects represent short-term commitments of money and manpower to insure that study area resources would be used to improve the environment for generations to come

Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action Should it be Implemented

These commitments generally concern changes set in motion by the proposed action which in the future could not be reversed, repaired, or restored to the present condition within a reasonable amount of time given current and likely future socioeconomic constraints In this level B plan, these commitments include (1) expenditure of resources such as capital, labor, energy, and various construction materials and equipment, (2) inundation of lands and stream channels by impoundments for hydropower and irrigation, stock-watering and fish and wildlife purposes; and (3) development of lands for irrigation and fish and wildlife habitat. In a sense allocation of surface water within the study area for Federal irrigation, hydropower, and other projects is also ireversible in that these commitments are linked to water storage, water conveyance, and other facilities which require long project lives to repay costs.

FUTURE ENVIRONMENTAL RESPONSIBILITIES

Implementation of the proposed action is the responsibility of various Federal and State agencies acting in cooperation with local officials. Federal agencies are obligated to comply with the National Environmental Policy Act of 1969, as well as earlier and subsequent environmental legislation and regulations. These include the Endangered Species Act of 1973 as amended, the Clean Water Act, the Fish and Wildlife Coordination Act of 1958, and the National Historic Preservation Act of 1966. Also included are executive initiatives such as Executive Orders 11593 (historic preservation), 11998 (flood plains), and 11990 (wetlands). In addition to meeting Federal standards, Montana State and local agencies are obligated to comply with various State environmental statutes, including but not limited to, the Environmental Policy Act of 1971, the Floodway Management and Regulation Act of 1971, the Water Use Act of 1973, the Major Facility Siting Act of 1973, the Subdivision and Platting Act of 1973, and the Stream Preservation, Natural Streambed, and Land Preservation Acts of 1975.

Compliance with the above environmental legislation would require State and Federal manpower devoted to monitoring, coordination, and planning activities as projects were implemented. Therefore, it would be important that affected agencies receive adequate funding for their responsibilities.

Implementation-related issues which may need further resolution at the site-specific level for the proposed actions include quantification and mitigation of adverse effects on environmental and fish and wildlife values, avoidance of flood plain and wetland disturbance where other practicable siting alternatives are available, surveys and assessments to determine the nature and importance of archeological and historic resources, quantification of wetland and riparian habitat values, detailed analysis of stream alteration impacts, examination of alternatives for improved water and energy conservation, identification of impacts on communities affected by project implementation, examination of the cumulative effects on the environment created by project implementation, identification of impacts on ground water recharge areas and high quality aquifers, and identification of impacts on vector populations and vector-borne disease.

The future role of the Missouri River Basin Commission in environmental and related matters involves coordinating further studies of environmental issues in the study area through its ongoing planning process. In addition, the Commission will determine funding priorities for programs and projects in the regional plan, assist in keeping State officials abreast of emerging Federal environmental programs and environmental issues which affect the subbasin, and review environmental impact statements on plan elements and other major Federal action for consistency with the level B plan and this environmental impact statement. Under the Water Resources Planning Act of 1965, the Commission is not an implementation agency.

LIST OF PREPARERS

The environmental data in this appendix and in supporting documents are largely based on information developed by the Study Team for the Upper Missouri Level B Study. The Study Team was an interagency team of specialists from various disciplines. A listing of individuals by discipline and agency is provided below.

PARTICIPANT	DISCIPLINE	AGENCY
Charles Adams	Naturalist	National Park Service
Gary Amestoy	Natural Science	Montana Department of State Lands
John Andrews	Geographer	Montana Department of Community Affairs
Ray Christensen	Geographer	Missouri River Basin Commission
Jim Cook	Economist	Forest Service
Richard Clark	Economist	Economics, Statistics, and Cooperatives Service
Milton Griffing	Economist	Soil Conservation Service
Duane Holmes	Recreation Planner	Heritage Conservation and Recreation Service
Ronald Lesniak	Civil Engineer	Federal Energy Regulatory Commission
Derwood Mercer (Jack Sutphin)*	Economist	Water and Power Resources Service
Larry Peterman (Don Brown)*	Biologist	Montana Department of Fish, Wildlife and Parks
Tom Sabin	Civil Engineer	Corps of Engineers
Gene Schmidt	Range and Forestry Specialist	Bureau of Land Management
Janet Smith (Dennis Christopherson)*	Biologist	Fish and Wildlife Service
Arnold Vinnard (Scott Brown)*	Economist	Montana Department of Natural Resources and Conservation
Kit Walther (Carlene Farmer and Steve Pilcher)*	Biologist	Montana Department of Health and Environmental Sciences

*Served at one time on Study Team

Other individuals responsible for drafting or reviewing the report and appendix materials included the Study Management Board for the Level B Study and the MRBC staff headquartered in Omaha. These individuals are as follows:

STUDY MANAGEMENT BOARD

Ralph Waddington, MRBC (Study Director)
Gary Fritz, Montana Department of Natural Resources and Conservation
Bob Fox, Environmental Protection Agency
Terry Lynott, Department of the Interior
Wallace Jolly, Department of Agriculture
Hans Foerstel, Canada (observer)
Gene Krenz, North Dakota (observer)
Norman Hollow, Indian Tribes

MRBC STAFF

Don Becker
Carl Teinert

LIST OF AGENCIES AND ORGANIZATIONS

The following list identifies those agencies, organizations, and individuals from who comments were requested or received with respondents indicated by "*"

Federal Agencies

Department of Agriculture
*Forest Service
Economics, Statistics, and Cooperatives Service
Soil Conservation Service

Department of the Interior
*Bureau of Land Management
Fish and Wildlife Service
National Park Service
Water and Power Resources Service
Bureau of Indian Affairs
Heritage Conservation and Recreation Service
*Department of the Army
Corps of Engineers
*Department of Energy
*Federal Energy Regulatory Commission

Environmental Protection Agency
Region VII Office, Kansas City, Missouri
*Region VIII Office, Denver, Colorado
and Helena, Montana
National Office, Washington, D.C.

Federal Emergency Management Agency

Department of Commerce
*National Oceanic and Atmospheric Administration

Department of Health and Human Services
*Public Health Service/Center for Disease Control

*Department of Housing and Urban Development

Department of Transportation

Other Governmental

Indian tribes
Chippewa
Cree
Assiniboine
Gros Ventres
Sioux
Blackfeet
Fisheries and Environment Canada
Big Blue River Compact Administration
Yellowstone River Compact Commission

Montana State Agencies

Honorable Thomas L. Judge, Governor of Montana
Department of Natural Resources and Conservation
Department of Community Affairs
Department of State Lands
Department of Health and Environmental Sciences
Department of Fish, Wildlife and Parks
Department of Agriculture
State of Montana Clearinghouse
Office of Budget and Program Planning

Other MRBC States

Honorable Richard D. Lamm, Governor of Colorado
Colorado Water Conservation Board
Honorable Robert D. Ray, Governor of Iowa
Iowa Natural Resources Council
*Honorable John W. Carlin, Governor of Kansas
Kansas Water Resources Board
Honorable Albert H. Quie, Governor of Minnesota
Minnesota Water Planning Board
*Honorable Joseph P. Teasdale, Governor of Missouri
Missouri Department of Natural Resources
Honorable Charles Thone, Governor of Nebraska
Nebraska Natural Resources Commission
Honorable Arthur A. Link, Governor of North Dakota
*North Dakota State Water Commission
Honorable William J. Janklow,
Governor of South Dakota
South Dakota Department of Water and
Natural Resources
Honorable Ed Herschler, Governor of Wyoming
Wyoming State Engineer's Office

Organizations

National Audubon Society
Rocky Mountain Representative

Nature Conservancy
Midwest Regional Office

Northern Plains Resource Council

Sierra Club
Northern Great Plains Representative

Other

*Atlantic Richfield Company

BIBLIOGRAPHY

Numerous resource materials were used or developed for preparation of the level B plan and environmental impact statement The primary sources of information were the plan report, technical papers, and selected Federal and State reports and EIS's All are available for review at the Missouri River Basin Commission, Omaha, Nebraska Limited copies of the technical papers are available These contain information about the water and land resources in the Upper Missouri River Basin and bibliographic data on natural resource studies completed in other areas. The following technical papers were prepared by the Missouri River Basin Commission during the course of the study:

Socioeconomic Characteristics and Projections, November 1978
Energy Water, May 1980
Inventory of Ground-Water Resources, February 1980
Agricultural Water, April 1980
Flood Control and Erosion, April 1980
Flow Characteristics of Selected Streams in the Upper Missouri River Basin, September 1979
Municipal, Industrial and Rural Domestic Water Supply, April 1980
An Inventory of Land Use and Ownership, December 1979
Land and Water Conservation Measures, November 1979
Environmental Characteristics, October 1979
Water Quality, April 1980
Outdoor Recreation, August 1979
Descriptions of Programs and Institutional Framework, June 1980
Fish and Wildlife, October 1979
Plan Formulation, September 1980

Other information developed previous to the study is available from State and Federal agencies. A few of the selected documents are as follows:

Design for Tomorrow, 1977-1980. Abbreviated version of the 1978 Montana Statewide Comprehensive Outdoor Recreation Plan, November 1978 Montana Department of Fish, Wildlife and Parks, Helena.

Instream Flow Evaluation for Selected Streams in the Upper Missouri River Basin, March 1979 Montana Department of Fish, Wildlife and Parks, Helena

Missouri River, South Dakota, Nebraska, North Dakota, Montana Draft Environmental Statement, March 1978 U S Army Corps of Engineers, Washington, D C

Supplemental Water for the Milk River, February 1977 Montana Department of Natural Resources and Conservation, Helena

LETTERS REQUIRING NO RESPONSE

SWC NORTH DAKOTA STATE WATER COMMISSION
900 east boulevard
701-224-2750
bismarck 58505
north dakota

September 4, 1980

Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

RE: SWC Project #1569

Dear Mr. Hall:

My staff and I have finished our review of the Upper Missouri River Basin Level B Study report which you had furnished to me with your letter of August 8, 1980. It is obvious that a great deal of work and thought has gone into the preparation of this document and we find it quite acceptable.

I hope that this plan will be favored with early implementation.

Sincerely yours,

Gene Krenz

Gene Krenz
Director, Planning Division

GK:mb

GOVERNOR ARTHUR A. LINK, Chairman
ALVIN A. KRAMER, Minor
ARTHUR L. LANZ
MYRON JUST, EX-OFFICIO MEMBER, Comm. of Agriculture
RICHARD P. GALLAGHER, Vice Chairman, Mandan
GORDON K. GRAY, Valley City
ARLENE WOHLEM
VERNON FAHY, Secretary & State Engineer

STATE OF KANSAS

OFFICE OF THE GOVERNOR
State Capitol
Topeka 66612

John Carlin, Governor

September 12, 1980

Dr. M. W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

Reference is made to your letter of August 8, 1980, transmitting for state review and comment the report of the Commission entitled "Upper Missouri River Basin Level B Study" July 1980. Included as part of the report is a draft environmental impact statement covering the Level B Study. I note that the report and EIS have been adopted as part of the Missouri River Basin Water Management Plan.

The Kansas Water Resources Board which serves as the designated representative to the Commission advises that the Level B Study is of direct interest to the upper basin area and, particularly, the State of Montana. The Board advises that the study was conducted through the Commission with participation from interested federal and state agencies and presents potentials and opportunities for managing the resources in the upper Missouri River region. The Board notes that the plan was reviewed by the Comprehensive Planning Committee and they recommended that it be incorporated as part of the overall management plan for the Missouri River Basin.

Inasmuch as the Level B Study is of direct concern to the upper basin area and the states of Montana and North Dakota, I feel that their views should take precedent with respect to future actions regarding the study and the environmental impact statement. Subject to the foregoing, I would have no objections to the report being incorporated and included as part of the total basin plan.

Sincerely,

JOHN CARLIN
Governor

JC:JMD:th

cc: Francine Neubauer
Executive Director
Kansas Water Resources Board

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE CENTRAL REGION
[illegible]
601 East 12th Street
Kansas City, Missouri 64106

September 19, 1980 OA/WFC2x1:RGM

Dr. Millard W. Hall
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall

Following are our review comments on the Upper Missouri River Basin Level B Study Including Draft Environmental Impact Statement.

Chapter IV-B, Flood Control - Nonstructural Measures, does not include flood forecast and warning services as a nonstructural alternative to mitigate flood damages.

River and flood forecasts and warnings for the Missouri River Basin are provided by the National Weather Service River Forecast Center in Kansas City, Missouri. These forecasts and warnings as described in the attachment are issued from National Weather Service Forecast Offices at Great Falls, MT, Bismarck, ND, Sioux Falls, SD, Cheyenne, WY, Denver, CO, Omaha, NE, Des Moines, IA, Topeka, KS, and St. Louis, MO.

Thank you for the opportunity to comment on the draft report.

Sincerely yours,

Glenn L. Audsley
Regional Hydrologist

Attachment

cc: Stephen L. R. McNichols, MRBC Member
Dr. Lee W. Larson, MRBC Alternate

Weather Service Statement on Flood Warning Program

The National Oceanic and Atmospheric Administration (NOAA) National Weather Service provides flood forecasting service for major river basins. This system involves predictions of anticipated stages at a particular gage or gages in the basin. These forecasts are based on observed precipitation and stages at upstream points and anticipated weather conditions. The flood forecast is transmitted to City officials, newspapers, and radio and television stations in the basin. These media disseminate the information to residents of the flood plain in the form of a flood warning. This timely forewarning permits protective measures to be undertaken by industrial plants, public utilities, municipal officials, and individuals with property in the low and [illegible] areas. Available are of the following types:

1. Flash Flood. The responsible weather service forecast office supplies weather forecasts twice daily for the state. In addition to the routine forecasts, special forecasts of severe storm and severe flash flood watches for small streams are issued as required. WSR-57 Weather Radar installations have capability for immediate detection and evaluation of rainfall intensity, location, and storm movement. Information is promptly relayed by teletype circuits and telephone to news media and community officials and law enforcement agencies. The Weather Service Office issues Flash Flood warnings as required for small streams in its area of responsibility.

2. Major Floods. River stage forecasts are based on radar coverage, reports from river and rainfall reporting stations and telemetering on or near the basin. The River Forecast Centers are staffed with professional hydrologists responsible for the preparation of river forecasts based on water equivalent of snow cover, rainfall runoff relationships, streamflow routing, and a working knowledge of anticipated weather conditions. The lead time between distribution of the forecasts and the flood crest may be short, however, lead time generally ranges from 12 hours for rainfall and up to several weeks for snowmelt. Specific crest forecasts are issued as required. River District Offices are responsible for the interpretation and distribution of flood forecasts and the operation of the hydrologic reporting station network in its area of responsibility.

3. Hydroclimatic Data. Most of the data from the network is not timely. These records provide the basis for forecasts as well as for the planning and design of protective works and their operation during floods. River and flood forecasting is fundamental in the design and essential in the operation of a levee or reservoir system.

LETTERS REQUIRING NO RESPONSE (Continued)

FEDERAL ENERGY REGULATORY COMMISSION
CHICAGO REGIONAL OFFICE
230 SOUTH DEARBORN STREET ROOM 3130
CHICAGO ILLINOIS 60604

October 7, 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
10050 Regency Circle
Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

I am responding to your August 8, 1980 letter addressed to Ronald Lesniak of this office requesting comments on the draft Environmental Impact Statement appended to the report titled, "Upper Missouri River Basin Level B Study - July 1980".

Since Mr. Lesniak was one of the work team members for the Study, we previously had the opportunity to comment on the preliminary draft of the Environmental Impact Statement. We have no additional comments to offer.

Sincerely,

Lawrence F. Coffill

Lawrence F. Coffill
Regional Engineer

cc: Chas. F. Metzger
Regional Representative
Region VIII - DOE
Lakewood, Colorado 80226

EXECUTIVE OFFICE
STATE OF MISSOURI
JEFFERSON CITY

JOSEPH P. TEASDALE
GOVERNOR

October 9, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

Thank you for the opportunity to review the Upper Missouri River Basin Level B Study. I view this as an important contribution to the factual understanding of the water resources of the Missouri River Basin.

My staff reports to me that the cumulative net water depletion projected by the study is 198,750 acre feet which is approximately equivalent to the water needed for six days of "full service" navigation on the Missouri River above Kansas City. This fact leads me again to urge speedy completion of the Missouri River Hydrology Study and a basin water use accounting system which will provide the facts on the impacts of consumptive water use on Missouri and other downstream states.

The basin need is to assemble all of this projected water consumptive use information so facts on cumulative effort will be available for decisions.

This letter is to serve as the Office of the Governor review of the study and the Draft Environmental Impact Statement.

Sincerely,

Joseph P. Teasdale

GOVERNOR

Atlantic Richfield Company 555 Seventeenth Street
Denver Colorado 80217
Telephone 303 575 7577

J. R. Mitchell
Public Lands Coordinator

October 9, 19[illegible]

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403, 1005 Regency Circle
Omaha, Nebraska 68114

Re: Upper Missouri Basin Level B Study and
Draft Environmental Impact Statement

Dear Mr. Hall:

Atlantic Richfield Company appreciates the opportunity to submit comments on the Missouri River Basin Commission's (MRBC) Upper Missouri Basin Level B Study and the Draft Environmental Impact Statement.

Atlantic Richfield agrees with the MRBC that without proper planning certain local and national needs may not be accommodated. Further, we agree that solutions to crucial problems involving water needs and uses are required. However, in addition to the water problems, we believe that the nation's domestic energy situation is also crucial and a solution to it is also necessary. We believe that the area studied possesses energy resource potential that would make a substantial contribution to the solution to the nation's energy problem. Accordingly, we recommend that future land use planning programs which may result from this study recognize the importance of energy resources and provide for the necessary encouragement for their exploration and development.

This study recognizes that the area is favorable for future energy and mineral resource exploration. For example, the study notes that about [illegible] million acres contain energy and mineral potential including some 35 million acres possessing oil and natural gas potential. However, no mention was made of the geothermal potential that exists in the area. We believe that the geothermal potential should be recognized along with the other energy resources. The southwest portion of this study area, particularly planning areas [illegible]2 and [illegible]3, contains land that has been classified by the United States Geological Survey as being potentially valuable for the exploration and development of geothermal resources. We recommend that any specific land management plan developed for this area recognize the potential for this alternative energy resource. Additionally, necessary cooperative leasing and exploration guidelines and regulations that will encourage the development of this potentially valuable alternative energy

Mr. Millard W. Hall
October 9, 1980
Page 2

resource should be included in any multiple use plan for these lands.

Additionally, the study recognizes that most potential mineral activities would have a minimal impact on water use and quality, but such activities could have some impact on land use on small localized areas. We agree that energy activities will involve only a small intrusion of the land and, in addition, this small intrusion on the land will be temporary. For example, the exploration phase for energy is of extremely short duration and, even if production is found, it generally lasts for only 35 to 40 years. Further, the area can be restored and returned to its natural state after production has terminated.

In summary, Atlantic Richfield strongly recommends that any future land use planning resulting from the study recognize the importance of all energy resources, including geothermal energy. In addition, necessary cooperative leasing and exploration guidelines and regulations that will encourage the development of these valuable resources should be included in any multiple use plan for these lands, where such an abundance of energy resources potential exist.

Again, we appreciate this opportunity to comment on this study and Draft Environmental Impact Statement. If you have any questions pertaining to our comments, please let us know.

Sincerely,

J. R. Mitchell

JRM:mlr:tbr

LETTERS REQUIRING NO RESPONSE (Continued)

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

REPLY TO ATTENTION OF

OCT 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for your letter of August 8, 1980, to the Secretary of the Army, requesting our comments on the Upper Missouri River Basin Level B Study - July 1980, and draft environmental impact statement.

We note that your report recommends additional studies (Phase 1) for Fort Peck, Montana, additional hydropower. As a matter of information, on April 4, 1980, we returned the August 1977 Review Report on the Missouri River, South Dakota, Nebraska, North Dakota and Montana, which includes the Fort Peck project, to the Chief of Engineers for additional studies. Our rationale for this action stems from the inefficiencies created by the two-phase authorization process (recommended in the report) and the current lack of information needed to support a construction recommendation.

The additional studies will be performed by the Omaha District of the Corps of Engineers. Those studies will address unresolved issues and will provide more detailed information on costs, benefits, and impacts. The Corps of Engineers currently anticipates initiation of the studies in Fiscal Year 1981.

We appreciate the opportunity to review the Level B study and draft environmental impact statement.

Sincerely,

Michael Blumenfeld
Assistant Secretary of the Army
(Civil Works)

United States
Environmental Protection
Agency

Region 8
Suite 103
1860 Lincoln St
Denver, CO 80295

Colorado Montana
North Dakota,
South Dakota
Utah Wyoming

EPA

Ref: 8MO

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for the opportunity to review the "Upper Missouri River Basin Level B Study," including the draft Environmental Impact Statement. Our comments are as follows:

1. We appreciate the consideration your commission has given to EPA comments in the pre-EIS stage of your planning effort. We note that many of our concerns have been incorporated in the Level B Study and draft EIS.

2. EPA strongly supports your commission's recommendations on water quality, fisheries, wildlife, protection of soils and agricultural lands, and other quality of life considerations. We believe your Level B plan correctly emphasizes the importance of these elements of environmental protection for the Upper Missouri area.

3. EPA reserves its opinion and position on the impacts of the potential irrigation and hydro-electric projects identified in your recommended plan pending complete analysis of these projects via separate feasibility studies and separate EIS's. As stated in the EIS, these projects could lead to the loss of significant free flowing stream mileage, agricultural lands, wildlife habitat, etc.. We would also add that the irrigation projects proposed for the Missouri River main stem could use a very large quantity of electrical energy. We fully understand that these detailed studies are not the function of Level B and that your commission recognizes they must be prepared by the agency actually proposing construction.

According to EPA's rating system this draft EIS is rated ER-1 (environmental reservations - sufficient information). Our reservations are related to the potential impacts that could be caused by the irrigation and hydro-electric projects. At the same time, we believe your report contains sufficient information for a Level B effort.

If you have further questions, please contact Mr. Gene Taylor in our Montana Office at (406) 449-5486.

Sincerely yours,

Roger L. Williams
Regional Administrator

cc: Dr. Kathleen Q. Camin, Regional Administrator, Reg. VII

MRBC Responses

U.S. Department of Housing and Urban Development
Office of Regional Administrator

Regional Office
Professional Building
1103 Grand
Kansas City, Missouri 64106

September 9, 1980

Mr. Willard L. Hall
Chairman
Missouri River Basin Commission
[illegible] Regency Circle - Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall

This is in reply to your letter to Secretary Landrieu transmitting the Draft Environmental Impact Statement (EIS) appended to the "Upper Missouri River Basin Level B Study," and requesting a Departmental review by October 9, 1980. This letter contains the official Department of Housing and Urban Development comments on the subject EIS.

The "Upper Missouri River Basin Level B Study" was found to provide a guide for management of water resources and was deemed acceptable for use in programming recommended water resources programs and projects in the Upper Missouri Basin.

In reviewing the appended draft EIS, however, the impacts on communities adjacent to construction portions of recommended projects appear not to have been fully identified or analyzed. First, as far as short term impacts are concerned, whenever projects are proposed analysis of impacts should consider the carrying capacities of adjacent local communities. Second, when more than one project is proposed within a limited geographical area and when these projects are projected to be under construction simultaneously, the cumulative impacts of the projects on the local communities need to be analyzed.

If not included in the final EIS, consideration of the above identified impacts should be included in Level [illegible] planning studies or in site specific studies and environmental assessments. In any case, further analysis of impacts is needed prior to project development or implementation.

Thank you for providing the Department the opportunity to review and comment on the Draft Environmental Impact Statement.

Sincerely,

William O. Anderson
Regional Administrator

The "Future Environmental Responsibilities" section has been modified to include the need for identification of impacts upon communities affected by implementation of the plan. Agencies with implementation or regulatory authority are responsible for this identification and mitigation of these impacts during implementation studies.

LETTERS REQUIRING RESPONSE (Continued)

MRBC Responses

United States Department of the Interior

IN REPLY REFER TO
1730(930)

BUREAU OF LAND MANAGEMENT
Montana State Office
Billings, Montana

SEP 19 1980

MEMORANDUM

To: Chairman, Missouri River Basin Commission

From: BLM Representative, Upper Missouri River Basin Level B Study

Subject: Field Review of Draft Environmental Impact Statement

The following is submitted in response to your letter inviting comments on the draft Environmental Impact Statement incorporated with the July 1980 main report on the Upper Missouri River Basin Level B Study.

Changes are proposed on twenty five of the thirty five pages comprising the EIS. A xerox copy of each of the twenty five pages is attached, with the proposed changes emphasized by color. Recommendations for added wording are underlined in red; the simple deletion of words is shown by a purple strikeout.

Each of two general recommendations for change has been repeated in a number of places. The first such change occurs in instances where the word "the", appearing unnecessarily, has been lined out.

The second general recommendation applies to the choice of grammatical tense used throughout the EIS. Where anticipated results of the proposed plan are referred to, the word "would" is recommended in lieu of the word "will". A provisional syntax is favored by logic, as illustrated in the following citation from BLM in-house guidelines on EIS preparation:

> "It is important to see that the word would, rather than will, is used when mentioning what the project would do or what impacts would occur. An EIS discusses what would happen should the proposal be implemented. It should not be implied that the proposal will be approved".
> (Underlining is part of the original quotation.)

Changes corollary to the above have also been indicated for such words as "could" instead of "can", "might" instead of "may", and etc.

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

Acknowledged. Numerous editorial and a few other changes were made in the environmental impact statement based upon items shown on enclosures.

In some cases, as illustrated by page 11, complete passages have been reworded to attain more precise meaning or improve organizational structure.

At several locations in the EIS use of the expression, "human environment", appears to be out of place. For example, in paragraph number 3, page A-3, it is stated that evaluations were made for 26 factors relating to the human environment. A number of the 26, such as "channel morphology", "endangered and threatened species", and etc., more or less exclude the human element. It is thus recommended that the word "human" be omitted in instances where it conveys too narrow a meaning. The proposed modifications are shown on the attached correction sheets.

Paragraph 4, page A-15, and paragraph 1, page A-17, have been modified to more nearly reflect Study Team intent in compiling Table 2, "Proposed Actions For Irrigated Agriculture".

Projects listed in Table 2 were those regarded as worthy of feasibility studies, but it was neither expected nor planned that all would be developed by year 2000. The figure of 370,700 acre feet net depletion (paragraph 4, page A-17) is therefore in excess of a realistic estimate. The proposed changes in paragraphs four and one thus illustrate a maximum theoretical effect that could occur in an ultimate case; that case would not develop under the current Level B scenario as visualized by the Study Team, however.

Encls. 25 pages

[illegible]

State Director, Montana w/encls.
Missouri Basin Planning Officer, DFO w/encls.
Jack Hutphin, WPSC, Billings, w/pp. A-15 & A-17

The enclosures have been detached and filed at the Commission office.

LETTERS REQUIRING RESPONSE (Continued)

MRBC Responses

Department of Energy
Washington, D.C. 20461

SEP 2 1980

Honorable Millard W. Hall
Chairman, Missouri River Basin
Commission
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Chairman:

We have been asked by Secretary Duncan to provide comments on your Upper Missouri River Basin Level B Study--1980. We are pleased to provide ynu comments on this important study.

We are pleased that the study recognizos the importance of hydropower by stating: "Hydropower projects will supply a source of clean and cheap electric power avoiding the necessity to depend upon foreign and domestic fossil fuel supplies." We agree with the Level B recommendation that the U.S. Congress should provide funding to the Water and Power Resources Service and Corps of Engineers for completion of feasibility studies on potential hydropower projects at Gibson, Tiber, Cannon Ferry, and Fort Peck Dams. Also, we agree that the Congress should fund the Water and Power Resources Service as lead agency, and other agencies as cooperators, in a comprehensive energy-environmental study of the Missouri River from Helena to Fort Benton. However, the proposed 1990 target for completion of this study should probably be shortened so that it might be more responsive to national energy needs.

We also agree that the Water and Resources Service should be encouraged to complete the reformulation study now underway on the proposed Fort Benton multipurpose project. As you know, the hydropower capacity of the project was initially designed for 360 MW. Because of the environmental constraints downstream, where a segment of the Missouri is now classified 'Wild and Scenic,' the reregulating reservoir initially planned must now be foregone. The various reformulations currently being examined for the Fort Benton project have hydropower capacity alternatives ranging from 60 to 160 megawatts. We strongly endorse the maximum level of development that is consistent with environmental objectives.

Additional comments relating to specific sections of the report are enclosed.

Sincerely,

Daniel M. Ogden, Jr.
Director, Office of Power
Marketing Coordination
Resource Applications

Enclosure

ADDITIONAL COMMENTS ON THE
UPPER MISSOURI RIVER BASIN
LEVEL B STUDY

1 -- Page I-1 The study summary identifies late season irrigation water shortages as a significant problem, noting that they affect half of the irrigated lands, or 700,000 acres. Page V-45, for example, indicates an overall shortage of 800,000 acre-feet (annual average). Further, the study notes that irrigation is the largest consumptive user of surface water accounting for about [illegible] percent of the total water used in the Upper Missouri River Basin. Improved irrigation efficiency, in terms of both physical methods and economics, therefore is at the core of improved water resources management in the Basin. Page V-46 indicates that improved farm facilities and management could reduce diversions by 1.6 million acre-feet. The study should give more focus to this element, perhaps using additional information on cost and practicable efficiency improvements from the recent BLM SCS study of irrigation efficiency. If appropriate, water saved through the institution of more efficient irrigation practices could perhaps be made available for other uses. Possible incentives for such conservation programs, such as permitting the irrigator to sell rights to the water conserved, should be explored as well as questions of equity that might arise in instituting effective state or federal programs for improved irrigation that may not affect all farmlands equally.

2 -- We note no extensive discussion of the possibility of low head small scale hydropower development. Is it possible that multiple installations (new or backfitted) of such systems could provide desirable alternative approaches for at least a portion of the capacity increases proposed for the larger dams?

3 -- Page II-1[illegible] This page says that extensive lignite deposits in the northeast basin might be mined in the future (see also page II-27). No discussion seems to be included on what this might mean in terms of water being available for coal development at the proper locations, synfuels plants (Page III-32 notes one such plant) or electric generation (Page III-32 says much future generation will be coal). What is the level of probability that such coal may or may not be mined extensively?

4 -- Page II-57 This page discusses federal programs related to energy water. Should there also be any mention of any leasing programs for coal development (BLM) or of DOE mandates for developing coal production and other targets that have to be matched with leasing activities, etc.?

5 -- Page III-15 Line 15 says no large federal projects are in final plans for construction. Are any at some earlier stage that would bear upon the Level B study?

LETTERS REQUIRING RESPONSE (Continued)

MRBC Responses

-2-

6. -- The report notes in several places (e.g., Page IV-41) that "reservations" for in-stream flow does not necessarily mean that water will be available. We might suggest that very clear definition of in-stream requirements (by States) and a more effective legal system for meeting those needs should be a recommended activity. These needs could affect power projects (see Page IV-40 for example, lines 20-23).

7. -- Page IV-42: We suggest that the text emphasize that in order to assure quality recreational use of the national wild and scenic river system, access corridors must be developed in a fashion which minimizes the adverse impact of their development and use.

8. -- Page IV-43: We also support the recommended improvement in baseline inventory of existing resources and keeping it current as a prelude to future planning. As is noted, such basic resource information would benefit those counties facing potential oil, gas, and coal development.

9. -- The report mentions several times the need to eliminate "thermal pollution" in the Madison River below Ennis Lake (e.g., Page IV-49) but I was not able to locate text on what causes this pollution. Report should clarify.

10.-- Page V-11: This page refers to citizen concerns about "fast track" legislation for hydropower making environmental protection difficult. This might also be a concern for synfuels development and similar assurances might be added re synfuels plant.

11. -- Page V-35: This page says five hydro plants in NED will have capacity of 183 MW and 383 MW under RP but will produce some GWH in both cases. Is this reasonable? It certainly implies that the RP is being overbuilt and no reasons (say perhaps better environmental control) are given. Should check this.

12. -- Page A-13: The system of symbols in the table does not seem adequate because there is no way of depecting a long term significant beneficial effect in a way that is different from a long term slight beneficial impact. The converse is also twice for adverse conditions and for short term significant vs. slight effects.

13. -- Page A-26: Mentions control of acid mine drainage. I thought that this was a relatively low level problem with western low-sulfur coals. Perhaps the cause and level of this problem can be better described.

The Commission recognizes that the symbol system employed for Table A-1 is inadequate for displaying the magnitude of both short and long-term effects. More information is available in the account tables for the NED, EQ, and Recommended Plans. Future environmental impact assessments of the Commission will attempt to develop a better methodology for evaluation of short and long-term effects.

The acid mine drainage problem is caused by both metal and coal mines. Typically, these mines have been abandoned without consideration for potential water quality degradation. Information about the acid mine problem is available in Chapter III of the plan and the water quality technical paper.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

October 3, 1980

Mr. Millard W. Hall
Chairman, Missouri River
Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

We have reviewed the Draft Environmental Impact Statement (EIS) and the Level B Study Main Report for the Upper Missouri River Basin. We are responding on behalf of the U.S. Public Health Service and are offering the following comments for your consideration in preparing the final document.

In general, we have no major objections to the proposed action. However, we believe that the significant beneficial and adverse health effects and issues associated with the proposed action and projects should be disclosed. Efforts should also be made to identify important groundwater recharge areas in the basin as well as high quality aquifers necessary for existing or future drinking water uses. What efforts have been made to identify the location of toxic and hazardous material dumps and sanitary landfills in the basin in order to assess and prevent potential surface and subsurface water quality degradation?

The Main Report and the EIS should briefly assess the impacts of the separate actions upon potential vector-borne disease problems. While the description of the Gibson Flats Watershed Project, Cascade County (page IV-27 of the Main Report) indicated a beneficial reduction of "disease vectors," no impact assessment is made of the other plan elements of the Level B Study. Western equine encephalitis has been an important public health concern throughout this entire region for many years, and the major vector species, Culex tarsalis, is both common and abundant. It breeds in association with irrigated agriculture and is produced in wastewater and other permanent water collections. Since a number of studies have demonstrated this disease problem, it is important that the EIS identify the beneficial and adverse effects of the plan elements upon vector populations and vector-borne disease problems.

We appreciate the opportunity to review this Draft EIS. Please send one copy of the final document when it becomes available.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Bureau of State Services

The level B study Main Report briefly discusses the ground water resources of the subbasin. The water quality technical paper provides additional detail on this subject. It is important to note, however, that future level C feasibility studies should evaluate the effect of project implementation upon ground water recharge areas and high quality aquifers. Each of these concerns should probably be items of study for future work to be undertaken by the State of Montana.

While the issue of toxic and hazardous wastes was not considered in the level B study, such wastes have been the focus of past State activities and will continue to be considered in future programs. Because of the relationship between waste disposal and ground water contamination, future Commission studies may also consider toxic and hazardous wastes.

The Commission acknowledges that risks to human health related to vector populations and vector-borne disease problems are concerns which should be considered in a general way during reconnaissance water and related land resources planning efforts. However, nonavailability of data for most water projects precluded the development of site-specific impacts on vector populations. Reconnaissance level studies such as level B analyses generally cannot collect field level data due to time and funding limitations. These concerns are generally addressed in the final environmental statement for "Flood Control" and "Irrigated Agriculture." Since additional work may be required for plan elements, these concerns have been included in the list of items deserving attention during level B feasibility study.

LETTERS REQUIRING RESPONSE (Continued)

MRBC Responses

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Federal Building, P.O. Box 7669, Missoula, MT 59807

REPLY TO 3520 River Basin Programs

OCT 6 1980

SUBJECT Review of Upper Missouri River Basin
Level B Study, Main Report, July 1980

TO Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

We have no comments on the DEIS; however, we do offer the following comments on the main report.

A section on problems as referenced in the Plan of Study and those problems which were identified at the public meetings is not yet presented in the report. Such a section would go well under Purpose and Scope on page 1-3.

Replace the section on Forestry on page II-27 with:

Timber Production

Of the 7,311,000 acres of forest lands in the area (14 percent of the study area), 4,128,000 acres (8 percent of the study area) are producing commercial forest products. Large areas of Federal commercial forest land are found the Beaverheads, the Highlands, and the Little Belt Mountains. The majority of the 140 million board feet of timber harvested annually comes off of private land. Federal timber lands are managed by the Forest Service and the Bureau of Land Management. The Blackfeet and Rocky Boy Indian Reservations also produce commerical timber products. The rest of the commercial forests are in State and private ownership.

State the amount of recreation days of consumption on page II-28.

Change line 20 on page II-55 to read: . . . lands and for supporting programs of the State and private sectors. The Act calls for planning and coordination with outside interest at the National, Regional, and Forest levels.

Change sentence starting on line 16 on page II-58 to read: . . . the National Park Service, USDI, or the Forest Service, USDA, upon authorization by Congress, would lead the study for possible inclusion in the system.

"Increased energy costs may decrease the number of irrigated acre in the future" may be added to paragraph on lines 15 to 18 on page III-17.

Consider adding the following idea to line 6, page IV-40, and to plan elements in table IV-2 on page IV-51: In some situations, a more cost-effective method might be to implement improved livestock grazing systems which will improve range condition on an entire area. Research in South Dakota showed that fenced ponds did not produce significantly more waterfowl than ponds in pastures under a deferred rotation system of grazing. Also, fenced ponds eliminate shore bird habitat which did not happen with the improved grazing system. Upland game bird habitat can be significantly improved with deferred rotation or other intensive grazing systems where the small amount of improved habitat in a fenced pond is insignificant.

Underline the words Recommended Plan (RP), plan elements, and recommendations on line 5 on page V-1. Underline plan elements on line 6 and underline Recommendations on line 9 on same page.

Add footnote to table V-1:

1/ The nonelement recommendations of the recommended plan are shown on table V-3, and the distinction between plan elements and plan recommendations is found in the first two paragraphs on page V-1.

Add footnote to table V-3:

1/ The plan elements of the recommended plan are shown in table V-1, and the distinction between plan elements and plan recommendations is found in the first two paragraphs on page V-1.

Columns (6) and (8) on table V-5 would be easier to understand if it were labeled or footnoted something like "difference between RP and NED (or EQ)."

I hope you will find these comments helpful in editing the final draft of the report.

James D. Cook

JAMES D. COOK
Resource Planner
Area Planning and Development

cc AP&D-WO

Since the plan was approved July 9, 1980, the Commission will not make changes in content prior to printing the final report. These comments may be considered and offered by the Secretary of Agriculture in his official review of the plan.

APPENDIX B
COMMENTS FROM OFFICIAL REVIEW

Public Law 89-80 requires that before the Commission submits a comprehensive joint plan or major portion thereof or revision thereof to the U.S. Water Resources Council,

> it shall transmit the proposed plan or revision to the head of each Federal department or agency, the Governor of each State, and each interstate agency, from which a member of the commission has been appointed, and to the head of the United States section of any inter-boundary water or a river crossing a boundary, or any tributary flowing into such boundary water or river, over which the international commission has jurisdiction or for which it has responsibility Each such department and agency head, Governor, interstate agency, and United States section of an international commission shall have ninety days from the date of the receipt of the proposed plan, portion, or revision after considering the reports so submitted. The views, comments, and recommendations submitted by each Federal department or agency head, Governor, interstate agency, and United States section of an international commission shall be transmitted to the Council with the plan portion, or revision. . .

Prior to initiating the required official review, the Missouri River Basin Commission adopted the report on the Upper Missouri River Basin Level B Study as part of the Commission's Comprehensive, Coordinated, Joint Plan for the Missouri River Basin. The Commission instructed that upon completion of the official review, the Chairman shall append the official comments received to the report.

The 90-day review was initiated August 8, 1980. All letters of official comment received from that review are included in this appendix. Some transmitted specific comments which are not reproduced here, but are on file at the Commission headquarters.

FEDERAL EMERGENCY MANAGEMENT AGENCY

Washington D.C. 20472

AUG 29 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, NB 68114

Dear Mr. Hall:

This is in response to your letter of August 8, 1980 requesting the Federal Emergency Management Agency (FEMA) comments on the Upper Missouri River Basin Level B Study of July 1980.

Although FEMA does not have any specific planning responsibilities in water basin projects or the evaluation of related environmental impact statements, we are deeply concerned with the preservation of inventories of critical resources which could support the population and industry in the event of a national emergency.

In the event of an attack upon the Nation, the much needed resource increases proposed by your study: (1) impounded useable water; (2) hydropower capacity; (3) agricultural irrigation capacity; (4) conservation of agricultural land by flood control and conservation; (5) increased water quality management; and (6) water transportation, would enhance the national survival inventory base and help in the survival and recovery effort. The improvements covered by your study will add to the emergency survival potential of the State of Montana by a significant factor in the critical resource areas listed above.

It may be useful to include the Montana Emergency Preparedness Office (Civil Defense) in the ad hoc group. They could help expand your statement on "beneficial effects" that will grow out of this proposal in the event of a national emergency.

In view of our mutual interest in emergency preparedness, and more specifically, the desirability of improving inventories of critical life and industrial support resources, I feel this proposal will have significant "beneficial effects" on the survival capabilities of Montana.

If any further assistance is needed, please contact FEMA's Acting Regional Director, Mr. Donald G. Eddy, (303-234-6542) FEMA Region VIII, Federal Regional Center, Bldg. 710, Denver, Colorado 80225.

Sincerely yours,

John W. Macy, Jr.

John W. Macy, Jr.
Director

cc: Mr. Eddy

Note: Additional comments from the Federal Emergency Management Agency are on file at the Commission office.

U.S. Department of Housing and Urban Development
Office of Regional Administrator

In Reply Refer to:

Regional Office
Professional Building
1103 Grand
Kansas City, Missouri 64106

September 5, 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 402
Omaha, Nebraska 68114

Dear Mr. Hall:

This is in response to your letter dated August 8, 1980, to Secretary Landrieu requesting comments on the "Upper Missouri River Basin Level B Study," (Main Report, July 1980). This letter transmits the official Department of Housing and Urban Development review of the subject study.

The report was reviewed and found to contain an adequate description of the water and related land resources problems encountered in the Upper Missouri Basin. The several recommended actions, including proposals to alleviate flooding or erosion, suggestions for detailed studies to better identify impacts of certain actions, recommendations for inventories of existing conditions before embarking on programs, and proposals for changes in existing legislation to better meet the needs identified, are all considered essential for effective management of water resources in the future.

The major purpose of developing a plan for coordinating water and related land resources management in the Upper Missouri Basin is served by this study. Implementation of the measures identified in the recommended plan will hopefully be achieved through joint cooperation and future actions at the local, regional, state, and Federal levels.

The review resulted in the determination that the Department has no major substantive concerns regarding the main text of the subject study. Therefore, the report is deemed acceptable for use in programming water resources programs and projects in the Upper Missouri Basin.

Review of the draft Environmental Impact Statement (EIS) appended to the Study has also been initiated. Comments and suggestions for revisions in the EIS can be anticipated. Official consolidated Departmental comments on the draft EIS will be transmitted separately as soon as possible and prior to the October 9, 1980, comment due date.

Sincerely,

William O. Anderson
Regional Administrator

ALBERT H. QUIE
GOVERNOR

STATE OF MINNESOTA

OFFICE OF THE GOVERNOR

ST. PAUL 55155

September 11, 1980

Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Chairman Hall:

I received your letter of August 8, 1980 and a copy of the report entitled, Upper Missouri River Basin Level B Study, July 1980.

The state of Minnesota does not choose to make specific comments concerning this document at this time. However, I have instructed my representatives on the Missouri River Basin Commission to review the study and, if appropriate, to offer Minnesota's views on the study during the designated review period.

Thank you for keeping me informed concerning the important activities of your organization.

Sincerely,

ALBERT H. QUIE
Governor

AHQ:ps

AN EQUAL OPPORTUNITY EMPLOYER

CHARLES THONE
GOVERNOR

STATE OF NEBRASKA

LINCOLN 68509

September 11, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

In response to your request, we have conducted a review of the report of the Upper Missouri River Basin Level B Study--July 1980. The plan is comprehensive and should be of considerable value to the people of the Upper Missouri River Basin.

The comments from the State of Nebraska are attached.

Sincerely,

Charles Thone

CHARLES THONE
Governor

CT:dwc

Attachment

IWCC

Interagency Water Coordinating Committee

memorandum

Date: September 12, 1980

To: Governor Charles Thone

From: Dayle E. Williamson, Secretary
Interagency Water Coordinating Committee

Subject: Upper Missouri River Basin Level B Study---July 1980

We have complied with your request to conduct a review of the Upper Missouri River Basin Level B Study---July 1980. This review was conducted by the Interagency Liaison Committee. In general, many of the resource issues discussed will not have a direct measurable impact on Nebraska. However, the Upper Missouri Level B Study recommended plan does provide for expanded hydropower generation and improved water quality through streamflow reservations and reduction in salt pick-up.

Comments on the specific irrigation, fish and wildlife, flood control, and outdoor recreation projects, etc. would not be in order due to our unfamiliarity with them.

The Missouri River navigation issue was also discussed in the plan. It is noted that the possibility of developing navigation on the Upper Missouri River was suggested by several citizens in their review of the planning activities. The planning team did review the potential for extending navigation up the Missouri above Sioux City, Iowa. This, of course, would require several locks and dams to be constructed around the existing mainstem dams and reservoirs. Two routes were analyzed and neither route was found to be economically feasible.

The plan is an excellent work effort, and the data base and issues discussed should be of considerable use to the people of the Upper Missouri River Basin.

Dayle Williamson

Dayle E. Williamson

DEW:cl

cc: Tom Eason, MRBC member
John Neuberger, Blue River Compact
Randy Moody, MRMO

Department of Energy
Washington, D.C. 20461

SEP 2 3 1980

Honorable Millard W. Hall
Chairman, Missouri River Basin
Commission
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Chairman:

We have been asked by Secretary Duncan to provide comments on your Upper Missouri River Basin Level B Study--1980. We are pleased to provide you comments on this important study.

We are pleased that the study recognizes the importance of hydropower by stating: "Hydropower projects will supply a source of clean and cheap electric power avoiding the necessity to depend upon foreign and domestic fossil fuel supplies." We agree with the Level B recommendation that the U.S. Congress should provide funding to the Water and Power Resources Service and Corps of Engineers for completion of feasibility studies on potential hydropower projects at Gibson, Tiber, Cannon Ferry, and Fort Peck Dams. Also, we agree that the Congress should fund the Water and Power Resources Service as lead agency, and other agencies as cooperators, in a comprehensive energy-environmental study of the Missouri River from Helena to Fort Benton. However, the proposed 1990 target for completion of this study should probably be shortened so that it might be more responsive to national energy needs.

We also agree that the Water and Resources Service should be encouraged to complete the reformulation study now underway on the proposed Fort Benton multipurpose project. As you know, the hydropower capacity of the project was initially designed for 360 MW. Because of the environmental constraints downstream, where a segment of the Missouri is now classified "Wild and Scenic," the reregulating reservoir initially planned must now be foregone. The various reformulations currently being examined for the Fort Benton project have hydropower capacity alternatives ranging from 60 to 160 megawatts. We strongly endorse the maximum level of development that is consistent with environmental objectives.

Additional comments relating to specific sections of the report are enclosed.

Sincerely,

Daniel M. Ogden, Jr.
Director, Office of Power
Marketing Coordination
Resource Applications

Enclosure

ADDITIONAL COMMENTS ON THE
UPPER MISSOURI RIVER BASIN
LEVEL B STUDY

1. -- Page I-1: The Study Summary identifies late season irrigation water shortages as a significant problem, noting that they affect half of the irrigated lands, or 700,000 acres. Page V-45, for example, indicates an overall shortage of 800,000 acre-feet (annual average). Further, the study notes that irrigation is the largest consumptive user of surface water accounting for about 80 percent of the total water used in the Upper Missouri River Basin. Improved irrigation efficiency in terms of both physical methods and economics, therefore is at the core of improved water resources management in the Basin; Page V-46 indicates that improved farm facilities and management could reduce diversions by 1.26 million acre-feet. The study should give more focus to this element, perhaps using additional information on cost and practicable efficiency improvements from the recent BLM/SCS study of irrigation efficiency. If appropriate, water saved through the institution of more efficient irrigation practices could perhaps be made available for other uses. Possible incentives for such conservation programs, such as permitting the irrigator to sell rights to the water conserved, should be explored as well as questions of equity that might arise in instituting effective state or federal programs for improved irrigation that may not affect all farmlands equally.

2. -- We note no extensive discussion of the possibility of low head/small scale hydropower development. Is it possible that multiple installations (new or backfitted) of such systems could provide desirable alternative approaches for at least a portion of the capacity increases proposed for the larger dams?

3. -- Page II-18: This page says that extensive lignite deposits in the northeast basin might be mined in the future (see also page II-27). No discussion seems to be included on what this might mean in terms of water being available for coal development at the proper locations, synfuels plants (Page III-32 notes one such plant) or electric generation (Page III-32 says much future generation will be coal). What is the level of probability that such coal may or may not be mined extensively?

4. -- Page II-57: This page discusses Federal programs related to energy/water. Should there also be any mention of any leasing programs for coal development (BLM) or of DOE mandates for developing coal production and other targets that have to be matched with leasing activities, etc.?

5. -- Page III-15: Line 15 says no large Federal projects are in <u>final</u> plans for construction. Are any at some <u>earlier</u> stage that would bear upon the Level B Study?

6. -- The report notes in several places (e.g., Page IV-41) that "reservations" for in-stream flow does not necessarily mean that water will be available. We might suggest that very clear definition of in-stream requirements (by States) and a more effective legal system for meeting those needs should be a recommended activity. These needs could affect power projects (see Page IV-40 for example, lines 20-23).

7. -- Page IV-42: We suggest that the text emphasize that in order to assure quality recreational use of the national wild and scenic river system, access corridors must be developed in a fashion which minimizes the adverse impact of their development and use.

8. -- Page IV-43: We also support the recommended improvement in baseline inventory of existing resources and keeping it current as a prelude to future planning. As is noted, such basic resource information would benefit those counties facing potential oil, gas, and coal development.

9. -- The report mentions several times the need to eliminate "thermal pollution" in the Madison River below Ennis Lake (e.g., Page IV-49) but I was not able to locate text on what causes this pollution. Report should clarify.

10.-- Page V-11: This page refers to citizen concerns about "fast track" legislation for hydropower making environmental protection difficult. This might also be a concern for synfuels development and similar assurances might be added re synfuels plant.

11. -- Page V-35: This page says five hydro plants in NED will have capacity of 183 MW and 383 MW under RP but will produce some GWH in both cases. Is this reasonable? It certainly implies that the RP is being overbuilt and no reasons (say perhaps better environmental control) are given. Should check this.

12. -- Page A-13: The system of symbols in the table does not seem adequate because there is no way of depecting a long term <u>significant</u> beneficial effect in a way that is different from a long term <u>slight</u> beneficial impact. The converse is also twice for adverse conditions and for short term significant vs. slight effects.

13. -- Page A-26: Mentions control of acid mine drainage. I thought that this was a relatively low level problem with western low-sulfur coals. Perhaps the cause and level of this problem can be better described.

State of Montana
Office of The Governor
Helena 59601

THOMAS L. JUDGE
GOVERNOR

October 8, 1980

Mr. Millard Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 86114

RE: Comments on Upper Missouri Level B Study

Dear Mr. Hall:

The Commission staff should be commended for their efforts in completing this study of the largest basin in Montana. The inventory and analysis will be valuable as we address the issues facing this important region in the coming years.

As the report recognizes, instream flow preservation is important and the legal allocation of water for instream flows is established by the Board of Natural Resource and Conservation in response to specific applications for instream reservation that has yet to be prepared. This means that specific allocations for instream and hence consumptive uses are determined as a result of the Board's decision or, specific applications. The Level B Study provides a valuable guide in indicating the benefits and consequences of alternative development levels but cannot serve as an inflexible plan for future decisions.

Best regards.

Sincerely,

Thomas L. Judge

THOMAS L. JUDGE
Governor

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

REPLY TO
ATTENTION OF

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for your letter of August 8, 1980, to the Secretary of the Army, requesting our comments on the Upper Missouri River Basin Level B Study - July 1980, and draft environmental impact statement.

We note that your report recommends additional studies (Phase I) for Fort Peck, Montana, additional hydropower. As a matter of information, on April 4, 1980, we returned the August 1977 Review Report on the Missouri River, South Dakota, Nebraska, North Dakota and Montana, which includes the Fort Peck project, to the Chief of Engineers for additional studies. Our rationale for this action stems from the inefficiencies created by the two-phase authorization process (recommended in the report) and the current lack of information needed to support a construction recommendation.

The additional studies will be performed by the Omaha District of the Corps of Engineers. Those studies will address unresolved issues and will provide more detailed information on costs, benefits, and impacts. The Corps of Engineers currently anticipates initiation of the studies in Fiscal Year 1981.

We appreciate the opportunity to review the Level B study and draft environmental impact statement.

Sincerely,

for Michael Blumenfeld
Assistant Secretary of the Army
(Civil Works)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
324 EAST ELEVENTH STREET
KANSAS CITY, MISSOURI - 64106

OFFICE OF THE
REGIONAL ADMINISTRATOR

NOV 24 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Chairman Hall:

As the Upper Missouri River Basin Level "B" Study was approved by the Commission at its 33rd quarterly meeting in July 1980, I would like to congratulate the participants in the planning effort on a job well done. We, at the Environmental Protection Agency, believe this Level "B" study to be a superior example of a Regional Water Resources Development Plan.

We are especially happy with the integration of water quality and water resource development issues. First, this Level "B" study has incorporated water quality concerns directly into the water resources development process. Second, it supports the water quality management programs of the State of Montana. Third, it identifies procedures, whereby, the negative environmental impacts of each plan element can be avoided or mitigated.

During the next several years EPA will give close attention to annual reports on implementation of this study. It is noteworthy that both the Muddy Creek Task Force and the Ennis Lake - Madison River Thermal Study have reported significant progress since the plan was approved less than four months ago. Continuing implementation will verify our judgments as to the value of this particular planning effort.

Thank you for the opportunity to comment on this plan. If you have any questions regarding our comments please contact me. The member of my staff who is most familiar with this subject, Mr. Jack Bale, (816) 374-6391, can also provide additional information.

Sincerely yours,

William Kuc

for - Kathleen Q. Camin, Ph.D.
Regional Administrator

STATE OF NORTH DAKOTA

EXECUTIVE OFFICE

BISMARCK

ARTHUR A. LINK
Governor

November 25, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
10050 Regency Circle, Suite 403
Omaha, NE 68114

Dear Dr. Hall:

We have reviewed the Upper Missouri River Basin Level B Study Report and find it to be a well written, well organized document. The report portrays an energetic effort on the part of you, your staff and the many people directly involved in the study to develop a coordinated water management scheme for the area. Although elements of the recommended plan have little direct impact on North Dakota aside from minor stream flow changes, we feel they are reasonable and consistent with the best interest of our state. We hope that plan implementation will closely follow your proposed schedule.

Sincerely,

Arthur A. Link

ARTHUR A. LINK
Governor

Office of the Governor

STATE CAPITOL
DES MOINES, IOWA 50319

ROBERT D. RAY
GOVERNOR

ELMER DUTCH VERMEER
ADMINISTRATIVE ASSISTANT

December 1, 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

The appropriate state agencies have reviewed the Main Report and Environmental Impact Statement (EIS) on the Upper Missouri River Basin Level B Study - July 1980 and have no substantive objections to the reports.

Therefore the State of Iowa is willing to provide the required sign off on this study.

Sincerely,

Elmer H. Vermeer
Administrative Assistant

EV:kjd

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

DEC 15 1980

ER-80/979

Honorable Millard W. Hall
Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for requesting the Department of the Interior's comments on the Upper Missouri River Basin Level B Study. (We previously forwarded detailed comments on the draft environmental impact statement). We have carefully reviewed the report and offer the following comments and suggested revisions.

General Comments

The Main Report is generally well-written and useful. Numerous sections have descriptions of institutional, physical, and economic conditions that should be considered by our land use planners and resource managers. For example, the numerous references to federal and state laws, by title and chapter, should assist the Bureau of Land Management in determining whether BLM plans, programs, and policies are consistent with state, local, and tribal plans, programs, and policies (as required by 43 CFR 1601.4).

The report describes as a part of the recommended plan the installation of 200 wells on the Gallatin Unit (Area 1002) to provide supplemental water to 51,139 acres and a full water supply to 7,957 acres (p.V-2). Table V-1 (p. V1-3, 4) indicates as land/water impacts the number of acres to be irrigated. The discussion of impacts should also address effects on aquifers and on any current use of ground water as well as the possibility of loss of streamflow through induced infiltration. For those units which would receive additional diversions of surface water for irrigation, the possibility for long-term rises in ground-water levels should be discussed.

Specific Comments

On page II-46, line 3, this statement is made: "The Montana Environmental Policy Act of 1971 is similar to the National Environmental Protection (emphasis added) Act. . ." The National Environmental Policy Act is the model for the cited state law and should be referenced in the statement.

We have additional language changes and technical corrections. Since the specific comments are quite lengthy, I have attached memoranda from the Heritage Conservation and Recreation Service, National Park Service, Bureau of Land Management, and Water and Power Resources Service for your review. Each memo contains suggestions which should be taken into consideration when preparing the final report.

Thank you again for the opportunity to review the report. I hope you will find our comments and recommendations helpful.

Sincerely,

Special Assistant to
Assistant Secretary,
Policy, Budget, and
Administration

Attachments (4)

Note: Attachments have been removed and are on file at the Commission office.

9830 1